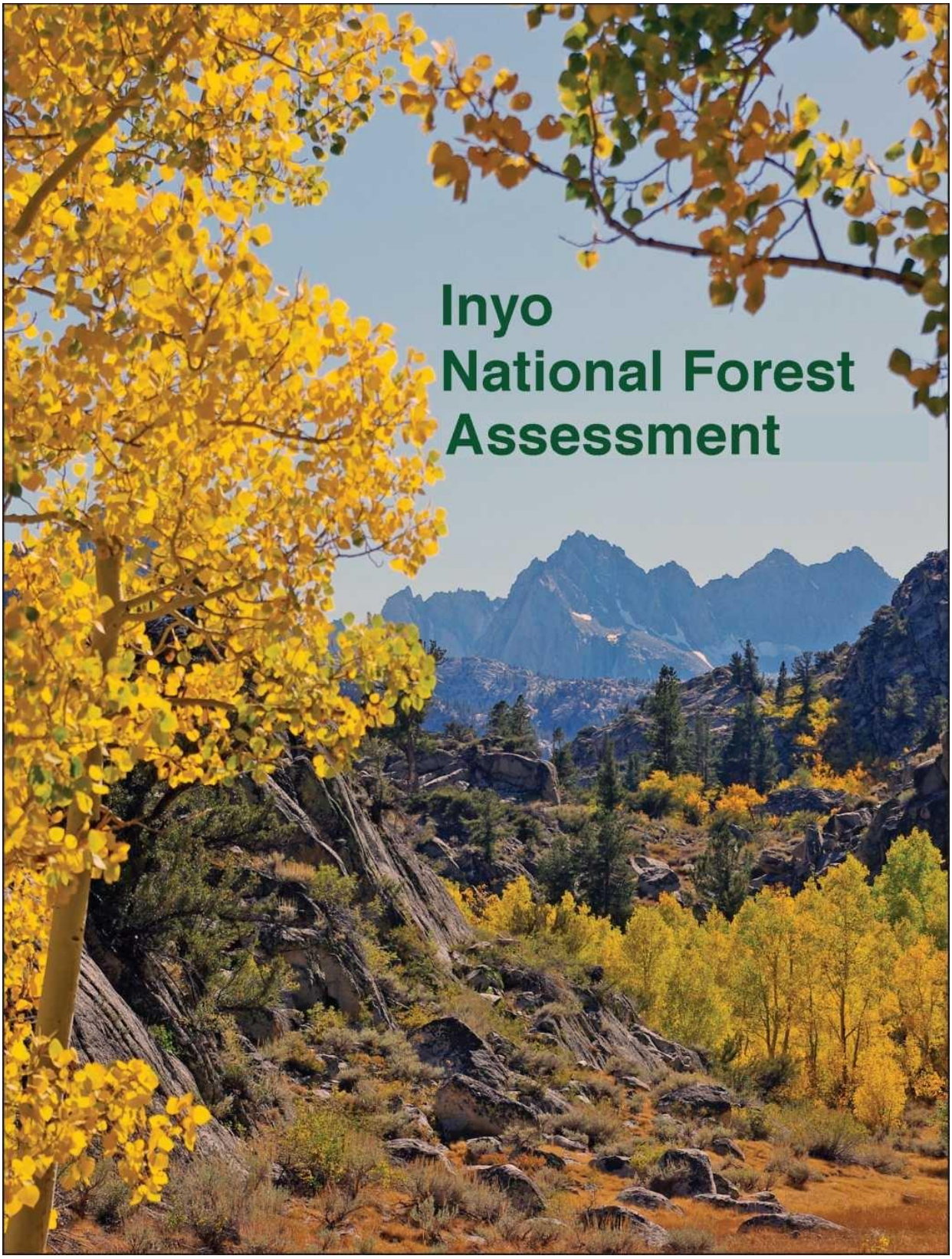
United States Department of Agriculture **Forest Service**



CONTENTS

INTRODUCTION

Purpose of the Assessment

The 2012 Planning Rule provides the process and structure to create local land and resource management plans for all national forests and grasslands. Land and resource management plans establish requirements and constraints for on-the-ground management decisions within a national forest or grassland. The rule establishes an ongoing, three phase process: 1) assessment; 2) plan development or revision; and 3) monitoring. The 2012 Planning Rule is intended to create understanding around landscape scale management. It takes an integrated and holistic approach that recognizes the inter-dependence of ecological processes with social and economic systems. The approach uses best available science to inform decisions along the way. Collaboration with stakeholders and transparency of process are key ways the 2012 Planning Rule guides creation of forest plans for the future.

This document represents the assessment stage for the revision of the Inyo National Forest's Land and Resource Management Plan and is designed to rapidly evaluate readily available existing information about relevant ecological, economic, and social conditions, trends, and sustainability and their relationship to the current land resource management plan within the context of the broader landscape. Assessments are not decision making documents, but provide current information on planning topics.

Structure of the Assessment

The Inyo National Forest is referred to throughout this document as "Inyo NF", or "the forest". The Inyo National Forest Land and Resource Management Plan is referred to as the "LRMP".

The Inyo NF Assessment begins with an INTRODUCTION to provide background about the process and to describe the assessment area. The next section is RESOURCES MANAGED AND EXISTING PLAN OBJECTIVES to help the reader with setting the context as the Inyo NF moves to forest plan revision under the 2012 Planning Rule. That is followed by an explanation of BEST AVAILABLE SCIENTIFIC INFORMATION. Next are FINDINGS for fifteen topics listed below. This section makes up the bulk of the assessment. CONCLUSIONS, REFERENCES, HELPFUL LINKS, and the Forest Service NON-DISCRIMINATION STATEMENT close out the assessment.

The Inyo NF Assessment identifies and evaluates existing information relevant to the plan area for the following topics laid out in the 2012 Planning Rule:

1. Terrestrial, aquatic, and riparian ecosystems
2. Air, soil and water resources and quality
3. System drivers and stressors
4. Baseline assessment of carbon stocks
5. At-risk species
6. Social, cultural, and economic conditions

7. Benefits people obtain from the assessment area: ecosystem services

8. Multiple uses: Fish/Plants/Wildlife, Water Uses, Timber and Range

9. Recreation settings, opportunities and access, and scenic character

10. Energy and minerals resources

11. Infrastructure

12. Areas of tribal importance

13. Cultural and historical resources and uses

14. Lands status and ownership, use, and access patterns

15. Designated areas, including wilderness and wild and scenic rivers, and potential for designated areas

Public Involvement and the *Living Assessment*

Both the public and the 2012 Planning Rule envision wider and deeper levels of engagement in forest plan revision. There are a variety of ways the Inyo NF has interacted with the public in the early stages of the planning process. There has been engagement with the public at numerous face-to-face meetings and technology has been used to interact virtually. Since 2010, the Sierra Cascades Dialog, a group made up of a broad spectrum of interested stakeholders, continues to be an important vehicle for engagement on forest planning at a regional level. The on-line community called Our Forest Place, a non-Forest Service site, is where members interact on blogs and in discussion groups, and where they can find information about forest planning and current events.

In May of 2013, the Inyo NF released draft "topic papers" describing current conditions and expected trends for the 15 assessment topics listed above. A wiki site, the *Living Assessment*, was set up to allow the public to add information to the 15 topic papers at both the bio-regional and forest scales. In addition, the topic papers were posted to the forest's website in downloadable Portable Document Format (PDF). Public feedback on the topic papers was accepted until September 1, 2013. This assessment report summarizes more detailed information found in the topic papers. The topic papers have been revised based on the public feedback received, and are available on the forest's website.

By using a wide variety of technology to outreach to stakeholders, there has been direct engagement in contributing to the content of the topic papers, not just reviewing the information. Many interested stakeholders provided important and valuable input, either directly on the *Living Assessment*, or through more traditional methods such as email or hard copy, creating a "living" body of work, in partnership with Forest Service specialists. This is an important shift in the approach to public involvement.

As stated above, the Inyo NF released draft topic papers for public review in May, 2013. Over the course of the next several months, the interdisciplinary team monitored public feedback received through email, on the wiki site, or in hard copy. The team gathered additional information, responded personally to questions and addressed concerns from contributors. As explained in more detail in the BEST AVAILABLE SCIENTIFIC INFORMATION section, the team evaluated the information provided by the

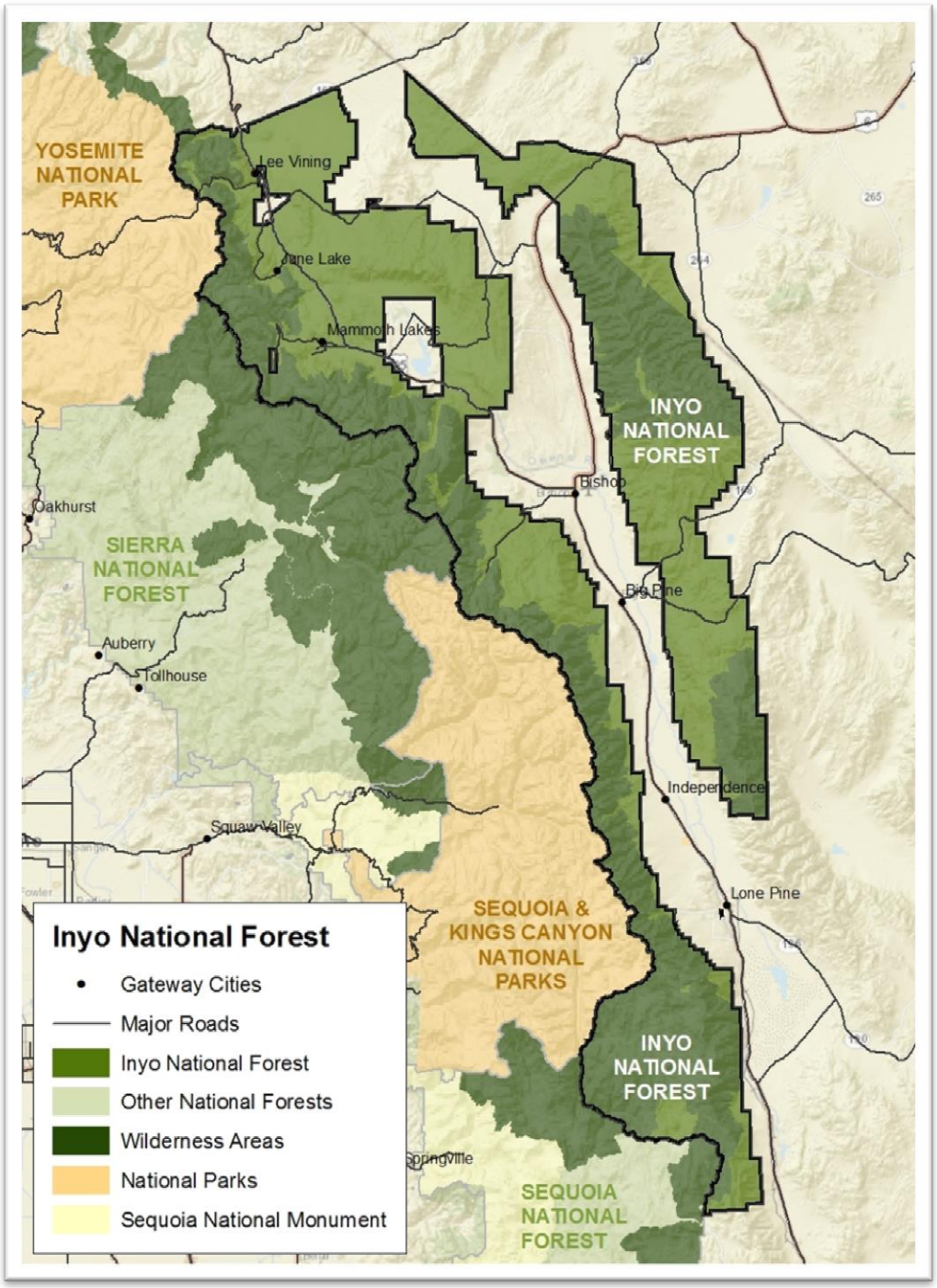
public to determine its relevance to the assessment phase of the plan revision process (Proposed Forest Service Handbook, 1909.12, Ch. 11, version 2/14/2013). The topic papers were revised based on the public feedback received.

The FINDINGS section represents the rapid assessment of existing information about relevant ecological, economic, and social conditions, trends, and sustainability, based on information contained in the 15 topic papers. The document is thoroughly cited and the complete REFERENCES section is found toward the end of the document. The reader is also provided information about where to find more detailed information in the revised topic papers, available on the Inyo NF website. These topic papers include an extended list of references.

Maps of the Assessment Area

The first map below shows the Inyo NF and where it lies within the State of California. The second map describes the boundaries of the forest. Wilderness areas displayed are only those managed by the Forest Service.

Inyo NF in California


YOSEMITE NATIONAL PARK
Lee Vining
June Lake
Mammoth Lakes
INYO NATIONAL FOREST
Bishop
Oakhurst
SIERRA NATIONAL FOREST
Big Pine
Auberry
Tollhouse
Independence
Squaw Valley
Lone Pine
SEQUOIA & KINGS CANYON NATIONAL PARKS
INYO NATIONAL FOREST
Springville
SEQUOIA NATIONAL FOREST
Inyo National Forest
Gateway Cities
Major Roads
Inyo National Forest
Other National Forests
Wilderness Areas
National Parks
Sequoia National Monument

Inyo NF

Assessment Area, History and Distinctive Features

The Inyo NF is truly a land of superlatives. The Inyo NF has the oldest living trees on the planet, the highest peak in the contiguous United States, the youngest mountain range in North America, and one of the oldest lakes in North America. Three major biological provinces converge in this unique area: the Sierra Nevada, the Great Basin, and the Mojave Desert. Geologic formations and rock types include volcanic craters, basalt flows, layers of ash and pumice, carbonate formations, and granite peaks, walls, and spires. With elevations ranging from 3,800 to 14,495 feet, the Inyo NF is home to a wide variety of ecosystems, supporting unique wildlife and plant species and a high level of biodiversity.

The Inyo NF is located in eastern California, with a small portion in Nevada. The forest includes the crest of the Sierra Nevada from the Mono Basin to the Kern Plateau, plus the Glass, White, and Inyo Mountain Ranges. Topographic relief is extreme, and 10,000 foot vertical gradients are found in three separate ranges on and adjacent to the forest. Mt. Whitney, the highest peak in the continental United States, is found on the Inyo NF, with an elevation of 14,494 feet. The Sierra Crest, combined with prevailing storm systems from the Pacific Ocean, creates a strong rain shadow, and the Owens Valley, Glass, and White-Inyo Mountain Ranges receive relatively little precipitation. The Inyo NF encompasses approximately two million acres, excluding Mono Lake, but including about 56,481 acres of private and state lands and 26,711 acres of the Sierra National Forest and Humboldt-Toiyabe National Forests, which are administered by the Inyo NF. Mono Lake is found within a designated national scenic area on the forest, and its waters cover approximately 37,277 acres. The Inyo NF has 964,361 acres of designated wilderness.

The eastern Sierra Nevada is known for its large expanses of undeveloped land. Other land managers in the region include the Bureau of Land Management (BLM) and the Los Angeles Department of Water and Power (LADWP). The communities within and adjacent to the forest are relatively small and discrete. Limited sprawl exists, so connectivity between the forest and similar ecosystems on adjacent lands is relatively intact with regard to development. The “checkerboard” pattern that is common on some Sierra Nevada national forests is limited on the Inyo NF. The forest shares boundaries with Sequoia-Kings Canyon, Yosemite, and Death Valley National Parks, the Devils Postpile National Monument, BLM, LADWP, private entities, and other national forests.

The uplift of the Sierra Nevada occurred ten to forty million years ago, with the White-Inyo Range uplift occurring later. As granite became exposed over time, the overlying sedimentary and metamorphic rocks eroded away in some areas, remained in some areas, and are still prevalent in the drier ranges to the east. There has been extensive historic volcanic activity on the lands now managed as the Inyo NF.

Over the last 65 million years, the regional climate developed from a warm, wet tropical climate to one characterized by cyclic glaciations, and current conditions of wet winters alternating with dry summers. The last major glaciation ended 10,000 years ago, but the Little Ice Age, which ended about 150 years ago, resulted in the advancement of many glaciers. Climate change over the last 150 years has been characterized by a warming period, with glaciers retreating again, and vegetation responses consistent with broad-scale warming. These climatic changes led to significant shifts in vegetation zones in the eastern Sierra Nevada. For example, pinyon pine forests were prevalent during cooler, wetter periods, but those areas are now dominated by sagebrush and desert scrub. Alternatively, many forest stands were established in a climate regime very different than current conditions, but they remain, like some stands of bristlecone pines in the White Mountains, and mountain hemlock in the Glass Mountains.

Indigenous human populations are known to have been in the Sierra Nevada for at least 10,000 years. Archeological evidence shows that these populations practiced land management, including agriculture and burning, for 3,000 years or more.

By the mid-1800s, Euro-Americans had settled in the Owens Valley. Native occupancy and practices continued, although on a much smaller scale and in limited areas. Mining practices in the surrounding mountains changed the landscape. Though placer mining was limited on the east side of the Sierra Nevada, a large number of smaller mines resulted in the development of a transportation network that brought humans into areas not previously well traveled. Logging of pinyon pine and Jeffrey pine was intensive in some areas as a fuel source for mining operations and growing urban centers. Fire suppression in more accessible areas was also common practice, and led to strong changes in forest composition and fuel structure in areas such as Mammoth Lakes. Water use and diversion from many of the major watersheds of the eastern Sierra Nevada has affected the landscape. Cattle and sheep grazing have been practiced for 150 years or more on the Inyo NF. Many meadow systems have been strongly altered during this period, by grazing, water diversions, and other stressors, such as climate change.

The east half of the Inyo NF includes the Glass and White-Inyo Mountain Ranges, and falls within the Great Basin and Intermountain Desert bio-regions. This portion of the forest abuts BLM lands and small portions of Death Valley National Park and the Humboldt-Toiyabe National Forests. These areas have a rich ecological and cultural history which differs from that of the Sierra Nevada. In particular, historic Euro-American use was more focused on livestock grazing and mineral prospecting than on timber. In the past, the presence of different fauna, including desert bighorn and pronghorn antelope, shaped the human use. Wild horses have impacted current management. On the lower slopes of the Sierra Nevada and eastward, dominance of pinyon pine, desert shrublands, and sagebrush creates an ecosystem far different from the west slope of the Sierra Nevada.

RESOURCES MANAGED AND EXISTING PLAN OBJECTIVES

Placed under federal protection and management in 1907, the Inyo NF has met the public's needs for more than a century. With its magnificent mountains, abundant natural resources, contiguous wilderness and endless recreation opportunities, the Inyo NF is one of the most popular national forests in the United States. The mission statement of the Inyo NF (USDA Forest Service 2007) is:

> *The Inyo National Forest provides vast open spaces in contrast to the urban environment. We collaborate with others to care for and conserve the Forest's Natural Ecosystem.*

The Forest Service manages National Forest System (NFS) lands to sustain the multiple-use of its renewable resources in perpetuity, while maintaining the long term health and productivity of the land. Resources are managed through a combination of approaches and concepts for the benefit of human communities and natural resources. Land and resource management plans (LRMPs) guide sustainable, integrated resource management of the resources within the plan area in the context of the broader landscape, giving due consideration to the relative values of the various resources in particular areas (36 CFR Part 219.1(b)).

The Inyo NF LRMP was completed in 1988. It has been amended multiple times to incorporate additional management direction for the Mono Basin National Forest Scenic Area (1989), forest-wide range utilization standards (1996), the Ansel Adams and John Muir Wildernesses (2001), the Sierra Nevada Forest Plan Amendment (2004), among others. The 1988 LRMP prescribes management direction for a combination of management practices for a variety of multiple uses, sets goals and objectives for desired future conditions, and provides for the multiple use and sustained yield of goods and services. The 1988 LRMP lists 24 goals for future conditions for a wide variety of multiple uses including recreation, wilderness, wildlife, fish, livestock grazing, timber harvest, minerals, soils, water, air quality, cultural resources, infrastructure, and fire management.

In this section, a brief discussion is presented of how agency budgets, management of forest resources, and risk factors (drivers and stressors) influence accomplishment of the objectives identified in the 1988 LRMP.

In large measure, the Inyo NF accomplishes the LRMP objectives to provide for a broad range of developed and dispersed recreation opportunities, maintain water quality, and other resource management objectives. Nonetheless, there is room for improvement and challenges exist, as discussed in more detail below.

The agency's budget is one of the most significant factors affecting accomplishment of plan objectives. The trend for a declining federal budget constrains many aspects of land and resource management, and therefore the ability to meet existing plan objectives for a variety of forest resources. As a consequence of declining budgets, the agency has fewer people and less capital for resource management actions, including, but not limited to:

- Managing recreation services, and maintaining or constructing recreation facilities and infrastructure for access, including roads and trails.
- Hiring backcountry rangers to support visitors and monitoring and protecting conditions for wilderness character.
- Maintaining roads and trails to ensure installation of appropriate drainage structure to address erosion and sedimentation issues.
- Monitoring water rights and water uses, leading to less certainty about the amount of water used on the Inyo NF, and any potential downstream effects associated with that level of use.
- Monitoring the status of wildlife and plant species to inform determinations related to the viability, or persistence, of species on the Inyo NF.
- Managing timber vegetation and the production of wood products, and less capital to implement projects which improve overall forest health and resilience.
- Eradicating or controlling noxious weeds to enhance ecosystem health and plant diversity.
- Completing post-implementation monitoring of project effects on forest resources such as rare plants, wildlife, and others.

The decline in agency budget and increasing public demand creates greater need for collaboration between the Inyo NF and partners, including private businesses, outfitters and guides, local governments, non-governmental groups and volunteers. As described in more detail in Chapter 9 of this assessment, partners currently provide a high degree of support to the Inyo NF by offering interpretive programs, opportunities for volunteer work and citizen stewardship, and special events to connect people with nature.

With the expected continued decline in agency budgets, partnerships and partner contributions will be even more crucial for sustaining interpretive services, conservation education, volunteer work and citizen stewardship, and special events to connect people with nature on the Inyo NF. Similarly, the contributions of partners and volunteers in maintaining or promoting recreational access, such as the maintenance of roads and trails, will become even more crucial in the future. The increasing need for partner contributions requires agency commitment for working with partners and investment in sustaining partnerships. Recent research suggests that building partnership skills in current Forest Service employees, such as the ability to negotiate and network, could also help achieve an increased level of collaboration with partners (McCreary et al. 2010).

While Forest Service funding is often limited, the Inyo NF has successfully secured outside funding sources to support projects to address a variety of resource concerns, including road and trail maintenance and meadow restoration, among others. In the past decade, the Inyo NF has received grants from many outside funding sources, including, but not limited to the California State Department of Parks and Recreation Off- Highway Vehicle Grants, National Fish and Wildlife Foundation, Sierra Nevada Conservancy, Army Corps of Engineers, and the Kern River Trust, either wholly or partially to implement projects such as road and trail maintenance, restoration of unauthorized routes, and meadow and stream restoration.

Many other factors affect accomplishment of plan objectives. For example, achieving goals for fire and fuel conditions requires treating a greater proportion of the landscape so that subsequent

fires will be smaller and less severe. However, because of a combination of factors, including special land allocations that apply to 75 percent of the Inyo NF (e.g., wilderness, inventoried roadless areas), budget and staff constraints, the pace and scale of treatments needed to meet this objective are difficult to achieve at best.

Of particular concern are lands within the wildland urban interface (WUI), where human habitation is surrounded by areas of flammable wildland vegetation. On the Inyo NF, special land status designations intersect with the WUI, often resulting in situations where priority WUI fuels reduction treatments are advisable, but the restrictions associated with certain special land status designations do not allow the treatments to occur, or limit the treatment options available so that the fuels reduction work is more complex or less economically viable. Special land status designations include inventoried roadless areas and designated wilderness, among others. Conversely, accomplishment of fuels reduction objectives, particularly within the WUI, can conflict with wildlife habitat management objectives. Fuels reduction treatments, while designed to protect urban areas from wildfires, can also potentially reduce the suitability of habitat for emphasis species such as northern goshawks or American marten.

There are a variety of risk factors which impact land and resource conditions and the ability to meet plan objectives, some of which are beyond the span of control of Inyo NF management. Ecosystem drivers are the dominant ecological processes, including disturbance regimes, such as wildland fire, natural succession, and the balance between the biological and physical components of an ecosystem, including climate (36 CFR 219.6(b)). Stressors may result in an imbalance of ecological processes, and include altered disturbance regimes, non-native species invasions, and climate change. Drivers and stressors are closely related, and have direct influence and feedback mechanisms with ecosystem structure and function.

External risk factors affecting recreation opportunities and designated areas on the Inyo NF include climate change, air pollution, population growth, national or regional economic conditions, and unauthorized uses of the Inyo NF. Climate change may impair future opportunities for winter recreation because of reductions in amount of snow or length of winter season. Other examples include air pollution from outside sources, loss of vegetation from wildfire which can degrade scenic quality, or a downturn in the regional or national economy which can cause a decline in local visitation and tourism. Another example, unauthorized uses, such as establishment of marijuana gardens, may affect the safety of visitors and impair water quality and other ecological resources. Finally, forest management is typically reactionary to evolving public expectations for recreation uses. Thus, management is typically "behind the curve" as new demands for recreation uses emerge. Unmanaged recreation can create environmental impacts such as spread of invasive species or degradation of water quality, and can result in overcrowding or conflicting or competing uses among visitors. In this context, unmanaged recreation use is a risk factor when considering ability to accomplish plan objectives.

Population growth, climate change, flooding, and wildfires are some of the primary risk factors associated with water and soil resources. Climate change may affect water flows or temperatures in the future. Population growth, primarily in southern California, is expected to result in increased demand for both consumptive uses such as drinking water, and non-consumptive uses such as recreation, of water from the Inyo NF. While it is difficult to determine if extreme weather patterns in recent years are within the normal range of variation, there are recent

examples of situations in which achieving objectives for some water uses took precedence over others. For example, in 2013, the popular reservoirs Lake Sabrina and South Lake were kept very low throughout almost the entire summer season, greatly reducing the quality of the non-consumptive beneficial uses of recreation and fishing. Following two years of drought, Southern California Edison, the operator of the dams and hydroelectric facilities associated with these reservoirs, was required to lower lake levels in order to meet instream flow requirements and legal obligations to provide water to downstream users. The Inyo NF cannot control climatic variables, or whether the lakes are filled or not, and therefore outside influences can greatly affect non-consumptive uses of water on the Inyo NF, now and in the future.

Flooding and wildfires are largely beyond the control of the Inyo NF, although land managers can choose how aggressively to fight a wildfire that occurs in a remote area, and can implement fuel treatment activities to help reduce the size and intensity of future wildfires. Wildfires, particularly moderate to high severity fires, generally increase soil erosion and decrease productivity. Lower severity fires such as prescribed fires, have little effect on soil nutrients. Flooding can lead to major, rapid erosion, particularly near stream channels.

For rare wildlife and plant management, drivers and stressors such as climate change may lead to changes in the amount of available habitat on the Inyo NF, potentially affecting the species' ability to persist on the Inyo NF. Current and potential habitat may contract in the long term due to warmer, drier conditions on the Inyo NF. Alpine species may be most affected by anticipated changes. Recent modeling forecasts a loss of alpine ecosystems from the White Mountains and a 30 percent reduction in the Sierra Nevada (Kim 2013). For example, changing climate has the potential to impact sage-grouse occupying higher elevation habitats, such as in the White Mountains, where drier weather patterns may lead to reductions in suitable brood-rearing meadows and the continued expansion of pinyon-juniper.

BEST AVAILABLE SCIENTIFIC INFORMATION

The 2012 Planning Rule requires the responsible official to use the best available scientific information (BASI) to inform the planning process. This section explains 1) how the BASI was used in developing the assessment, and 2) how key scientific information was determined to be BASI, based on what is most relevant, accurate, and reliable.

In developing the topic papers for the 15 assessment topics, Forest Service specialists relied on information supported by publications, scientific assessments, federal agency inventory and monitoring data, and other sources of scientific information such as expert opinion where available and which addressed the 15 topics. Other information sources used in the development of the draft topic papers include the Science Synthesis Report and the Bio-Regional Assessment.

The draft topic papers were made available to the public on the *Living Assessment* and the Inyo NF website in May, 2013. The Forest Service invited the public to submit additional information, including scientific information that may be relevant to the planning process. Stakeholders provided feedback on the content of the topic papers, as well as additional references and information directly on the *Living Assessment* or through email or hard copy letters. Public feedback on the draft topic papers was accepted through September 1, 2013.

During and after the close of the comment period, the Inyo NF interdisciplinary team evaluated the information provided by the public and obtained from other sources including the Science Synthesis Report and the Bio-Regional Assessment to determine its relevance to the assessment phase of the plan revision process (Proposed Forest Service Handbook, 1909.12, Ch. 11, version 2/14/2013). Specifically, the team considered whether the information helped inform the assessment of conditions and trends for the 15 assessment topics or was relevant to the sustainability of social, economic, and ecological systems.

The information from these sources was evaluated to determine if it was relevant to the scope and scale of the question at hand, if it was accurate, and if it was reliable. High quality and valid scientific information was considered particularly valuable. This type of information is characterized by clearly-defined and well-developed methodology, logical conclusions, reasonable inferences, adequate peer-review, suitable quantitative methodology, proper spatial and temporal context, and the use of relevant and credible citations.

To be relevant, the information must pertain to the 15 topics under consideration at spatial and temporal scales appropriate to the plan area and to a land management plan. Relevance in the assessment phase means scientific information that is relevant to the conditions and trends of the 15 topics in 36 CFR 219(b), or to the sustainability of social, economic, or ecological systems (36 CFR 36 219.5(a) (1)).

Accuracy and reliability of relevant information was determined by comparing the scientific quality of the information, and using the highest quality information available. Under the draft directives, higher quality information is identified as having greater accuracy, reliability, relevance, credibility, and pertinence. Information without appropriate supporting citations or references was considered to be of lesser quality under the draft directives.

Uncertainties in scientific information were pointed out and discussed where they potentially affected conclusions. In cases of competing scientific conclusions, if the information appeared to be of comparable scientific quality, then both points of view were carried forward and a data gap was identified as to the final conclusions. Public feedback throughout the planning process will help ensure that the most relevant, accurate, and reliable information is considered.

The topic papers have been revised based on the public feedback received, and form the foundation of the FINDINGS and CONCLUSIONS sections of this assessment. The revised topic papers are available on the forest's website. Key assumptions in determining BASI, in addition to those documented in the assessment are documented in the administrative record and the information sources sections of each topic paper. References included in this assessment reflect a summary of the most relevant BASI sources for the 15 topics, given the scope and scale of the assessment. Additional references are contained in the topic papers.

FINDINGS

Chapter 1: Terrestrial, Aquatic, and Riparian Ecosystems

Important Information Evaluated in this Phase

Ecological integrity is defined as the degree to which ecosystems are represented across the forest and functioning properly. For example, meadows are still well represented and are not substantially reduced in extent. Forests still provide habitat for native plant and animal species at levels that allow them to persist through fire, drought, and climate change. In more technical terms, the 2012 Planning Rule draft directives define it as:

> the quality or condition of an ecosystem when its dominant ecological characteristics (for example composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence.

Biodiversity, or the living component, is central to ecological integrity. Most simply, it is the diversity of life. More formally, according to the Congressional Biodiversity Act HR1268 (1990):

> Biological diversity means the full range of variety and variability within and among living organisms and the ecological complexes in which they occur, and encompasses ecosystem or community diversity, species diversity, and genetic diversity.

In this chapter, conditions and trends of ecological integrity are described and evaluated separately for the three major ecosystem types: terrestrial, aquatic, and riparian.

This chapter summarizes the Inyo NF Chapter 1 Topic Paper on Terrestrial, Aquatic, and Riparian Ecosystems. The primary data sources used were literature reviews conducted by the Forest Service Pacific Southwest Region Ecology Program on the Natural Range of Variability of dominant vegetation types for the Bio-Regional Assessment (Estes2013a and b, Gross and Coppoletta 2013, Meyer 2013a and b, Safford 2013, Slaton and Stone 2013a and b), the Bio-Regional Living Assessment, the Science Synthesis by the Pacific Southwest Research Station (Long et al. 2013a), research by the Rocky Mountain Research Station (Chambers 2008), and other peer reviewed literature. Forest Service databases were used. Key among these were the ecology program database for the Inyo NF including 400 plots and Terrestrial Ecological Unit Inventory (TEUI) mapping (potential natural vegetation, geology, and soils), the Inyo NF Forest Plan Amendment 6 riparian monitoring data, and inventories associated with grazing allotments. The discussion is organized by broad ecosystems, defined mainly by dominant vegetation, and referred to as 'assessment types'.

Nature, Extent, and Role of Existing Conditions and Trends

These assessments focus on the current condition of the terrestrial, riparian and aquatic ecosystems of the Inyo NF. Current conditions, special habitats, biodiversity, ecological integrity, and natural range of variability for these three major ecosystems are assessed. In some sections, broader patterns for the larger bio-region were also discussed.

Characteristics of Ecological Integrity

Ecological integrity is simple in concept to define, but more difficult in practice to assess. Under the 2012 Planning Rule, "natural range of variability" is a key means for gauging ecological integrity. Ecosystem sustainability is more likely if ecosystems are within the bounds of natural variation, rather than targeting fixed conditions from some point in the past (Wiens et al. 2012). For a number of important ecological characteristics, such as snags or mixes of habitat types, there is limited or highly uncertain information on the natural range of variability available. A combination of the two types of ways to assess ecological integrity was included here.

A limited suite of ecosystem characteristics were selected to assess ecological integrity based on:

- the information was readily available
- the characteristic is relevant to key issues and sensitive to drivers and stressors
- the characteristics represent elements not covered in other chapters

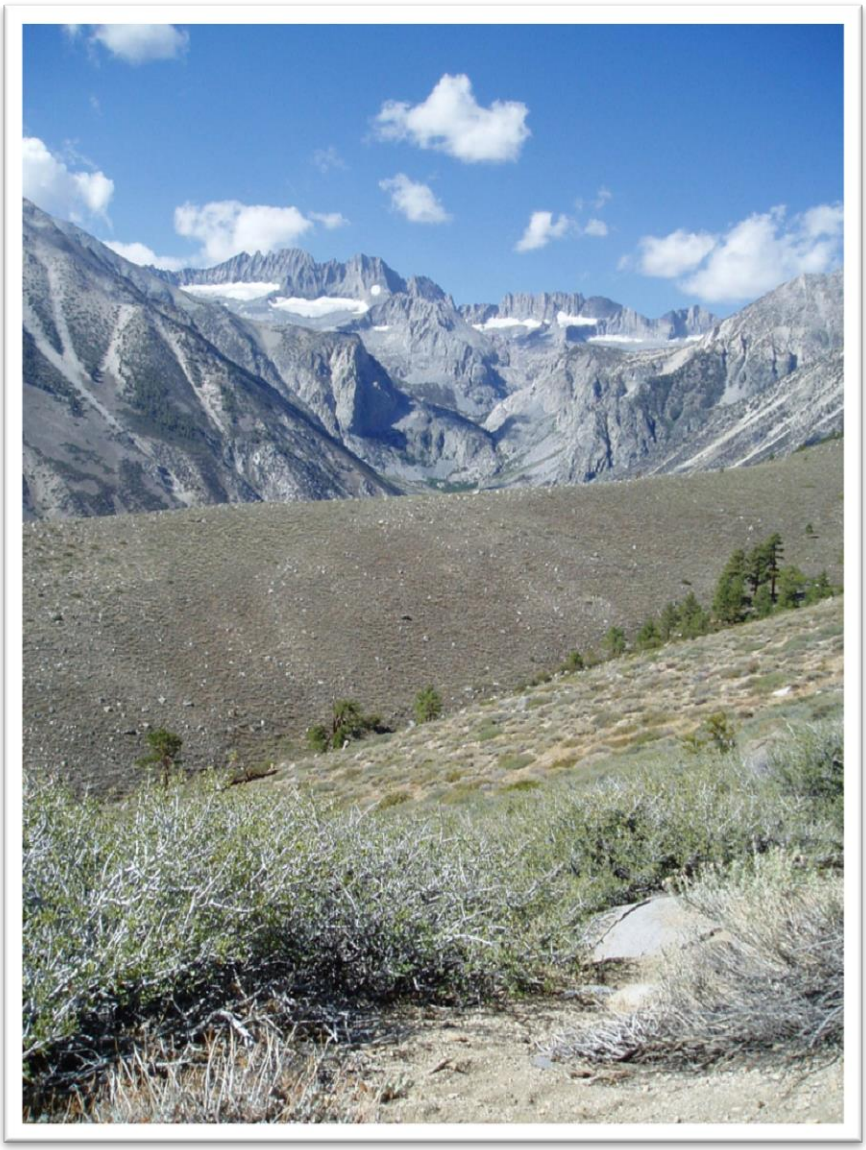
The suite of ecosystem characteristics selected to assess ecological integrity included:

- natural range of variability of vegetation
- vegetation diversity (communities, within-stand complexity, large trees, snags)
- special habitats (e.g. aspen, complex early seral, old forest)
- fire as an ecological process
- connectivity (overall, old forest, and special management areas)

Terrestrial Ecosystems

Land-based, or terrestrial ecosystems, are diverse on the Inyo NF. There are changes with elevation and moisture, and changes from north to south and east to west. With elevations ranging from approximately 3,800 to 14,495 feet, this sets the stage for a wide variety of ecosystems. Three major biological provinces – the Sierra Nevada, the Great Basin, and the Mojave Desert - converge in this unique area. The deserts to the south are drier, and the rain shadows created by the Sierra Nevada create drier conditions in the Glass, White, and Inyo Mountains to the east.

The photo below shows the range of terrestrial ecosystems on the Inyo NF. In the background, the tall, sparsely vegetated, steep, eastern slopes of the Sierra Nevada are visible, with the Palisades of Big Pine Creek prominent in the center right. A glacier is nestled below the steep peak tops but only covers five percent or less of the slopes. In the foreground is a gentle slope covered by a low growing stand of sagebrush and other shrubs. The shrubs are low growing, several feet or less, with continuous cover (more than 70 percent), and include desert ceanothus, mountain sagebrush, and rabbitbrush.



View of Sierra Nevada on the Inyo NF

Across the different geographic areas, a variety of dominant vegetation types occur, which correspond to the 'assessment types' developed in the Chapter 1 Topic Paper. At the lower elevations and drier areas, a mosaic of sagebrush, Pinyon-juniper woodlands, and xeric shrublands and blackbrush occur. Where there is more precipitation, open stands of Jeffrey pine occur, either pure or with scattered Pinyon pine or fir. Red fir forests occur primarily on the Kern Plateau and Mammoth Lakes areas, where more precipitation, especially in the form of snow dominates. Above that, covering at least one-third of the Inyo NF are subalpine forests and woodlands. Finally, an alpine area, without trees, covers the highest elevations. A description of the composition of dominant plants, and important factors affecting changes over time (drivers and stressors) for each of these broad assessment types is included below.

Pinyon-Juniper

Pinyon-juniper is the most extensive assessment type on the forest, covering over 500,000 acres. This assessment type dominates mid-elevations across the forest, and occurs in all ecological sub-regions. Pinyon-juniper types often occur in close proximity to and mixed with sagebrush shrublands, mountain mahogany, and xeric shrublands. Pinyon-juniper has the greatest acreage of mapped disturbances of all assessment types, including fires and roads, although the relative proportion that is disturbed is low (about 13 percent) due to the very large extent of this ecosystem on the forest. Twenty-two species of non-native invasive plants are found in Pinyon-juniper and cheatgrass and red brome have a 33 percent frequency in forest ecology plots. Invasive annual grasses are common near roads and in burned areas.

Some of the areas on the forest currently classified as pinyon-juniper woodlands include sagebrush shrub communities that have experienced an increase in pinyon and/or juniper trees over the past several decades or longer. This "encroachment" is due to a combination of factors that include grazing, fire suppression, and climate changes, and the consequent effects on fine fuels, nutrient cycling (soil crusts), and community structure and composition.

Sagebrush

Sagebrush shrublands are another prominent vegetation type on the Inyo NF. Dominant species include all subspecies of big sagebrush, low sagebrush, bitterbrush, and black sagebrush. Some of the areas currently dominated by Pinyon-juniper were dominated historically by sagebrush, and a combination of management history and climate change has allowed Pinyon-juniper to expand.

Early and mid seral ecosystems comprise approximately 15 percent of sagebrush areas. These mainly include burned areas currently dominated by herbaceous vegetation or by shrub species that increase rapidly following fire, such as rabbitbrush. Encroachment of conifers into sagebrush over the last century has resulted from the combined effects of fire suppression, grazing, and climate change, with an estimated 25,000 acres of sagebrush with encroachment of several trees per acre or more. Conifers have been removed in some areas to improve sage grouse habitat. Twenty-eight non-native, invasive species are found in sagebrush, and cheatgrass and red brome have a 19 percent frequency in forest-wide ecology plots. Amendment 6 grazing data indicated that of 58 transects, 35 were excellent, 13 were good, 10 were fair, and none were poor with respect to vegetation condition.

The photo below shows the sagebrush type, which often occurs across large expanses. Across most of the front and middle of the photo, sagebrush shrubs interspersed with bare areas or perennial grasses and herbs can be seen extending across a broad plain to the mountains in the far distance. Sagebrush cover is moderate to high, with about 40 to 60 percent canopy cover. This is the more common sagebrush species, mountain big sagebrush.

Sagebrush landscape at Crowley Basin on the Inyo NF

Xeric Shrub/Blackbrush

A diverse array of desert shrubs, grasses and herbs comprise this type. Blackbrush, saltbush, goldenbush, and horsebrush are common shrubs. It occupies the very lowest elevations of the Inyo NF, approximately 11 percent of the forest, in the foothills of the mountains, bordering the large valleys extending on adjacent land managed primarily by the Bureau of Land Management or Los Angeles Water Department. Past and current management activities and/or natural processes that have affected the current condition of xeric shrub and blackbrush ecosystems on the forest include livestock grazing, fire suppression, wildland fire, mining, water spreading, various special uses such as apiaries and weather stations, and recreation uses, particularly OHV activity.

The photo below shows a small patch of xeric shrubland in a small saddle between two adjacent slopes, seen in the background. Scattered Joshua trees can be seen of varied sizes. A small one with yellow green spikey leaves coming in a tight clump out of the ground is seen in the foreground. In the mid-ground behind it on the right is an older Joshua tree, with multiple grayish brown stems, with the same clumped yellow green spikey leaves on the end. Some of the clumps have white, dead leaves at the base. Across the rest of most of the photo a field with a moderate cover of dry, grayish, thorny, rounded shrub clumps, and interspersed tan herbs and grass clumps can be seen. The photo is during a season when there are few deciduous leaves and no flowers visible.

Xeric shrubland at upper limits of Mojave Desert on the Inyo NF

Jeffrey Pine

The Jeffrey pine type includes "pure" Jeffrey pine forest, as well as Jeffrey pine in combination with Pinyon, lodgepole pine or western white pine, limber pine, and fir in small amounts. It covers between five and eight percent of the forest. The understory in this type varies from low cover of grasses and herbs, to sagebrush and bitterbrush scrub and/or montane chaparral. Jeffrey pine forest is found scattered along the escarpment of the Sierra Nevada, on the Kern Plateau, and most commonly in the Glass Mountains, Mono Valley, and Upper Owens River area. These areas have been managed for timber in the past. See Chapter 8-Timber of this assessment for additional information. Invasive annual grasses are patchy, confined to disturbed areas such as timber landings.

Considerable fragmentation of this type has occurred due to the presence of roads, with road density more than two-fold greater than in any other assessment type. Recent travel management restoration activities have reduced fragmentation in some areas. Past and current timber harvest and fire suppression are the primary drivers/stressors of Jeffrey pine ecosystems. Fires currently occur less frequently than they did prior to Euro-American settlement. Please see the Natural Range of Variability section below and Chapter 3 Inyo NF topic paper for further discussion.

The photo below is of open Jeffrey pine woodland, with a mountain big sagebrush understory.

Jeffrey pine on the Inyo NF

Red Fir Forests

The red fir forests most often have a high canopy cover with a very sparse cover of herbs and shrubs (Potter 1994). Some openings with montane chaparral occur in patches. Lodgepole, Jeffrey, and western white pine, and mountain hemlock can be found mixed in this type. The majority of the red fir type is located on the Kern Plateau and Reds Meadow Valley areas, although some isolated stands occur along the eastern escarpment. Red fir types encompass about six percent of the national forest.

Recreation is popular within the red fir forest, and includes campgrounds, OHV activity, dispersed camping, and resorts. Both of the downhill ski areas on the forest are located at least partly within the red fir assessment type. In November of 2011, a significant wind event occurred across the Inyo NF and neighboring national parks and forests. Approximately 220 acres in the Reds Meadow area on Inyo NF lands outside of wilderness were reported as having severe tree damage, primarily affecting mature red fir and lodgepole pine. The photo below illustrates a red fir forest, with a large tree in the foreground, exceeding five feet diameter breast height (dbh), a sparse understory, and denser red fir and lodgepole pine in the background.

Red fir on the Inyo NF

Mixed Conifer Forests

Various combinations of white fir and/or one or more other conifer species, and sparse understory characterize the mixed conifer forests. It occurs at the lower edge of the subalpine or red fir types, and the upper edge of the sagebrush/Pinyon-juniper woodlands, across two percent of the forest. This assessment type is most prominent on the southern portions of the Kern Plateau, and it occurs in a limited elevation band along the eastern escarpment.

Other than fire suppression, management activities in the past few decades in the mixed conifer forest assessment type in wilderness have been limited primarily to non-motorized recreation. Outside of wilderness, recreation residences, resorts, and campgrounds are sometimes located within this assessment type.

In the photo of mixed conifer below, canopy cover is high of overstory trees, shading the sparsely vegetated, needle carpeted ground below. The slope is generally flat, with several large (greater than 15 inch diameter) gray logs across the center and foreground of the photo. A single, low growing shrub, with grayish green leaves, a ceanothus, is seen in the understory. Closely growing, irregularly spaced white fir, Jeffrey pine, and incense cedar comprise a two-layered canopy of about 60 percent cover. The trees vary in size from more than 20 inches diameter to about 8 to 12 inches. On the left side of the photo, a partially burned skeleton of an incense cedar greater than six feet in diameter breast height (dbh) is visible.

Mixed conifer ecosystem on the Kern Plateau

Mountain Mahogany

Large patches of mountain mahogany occur on steep cliffs, rocky slopes and outcrops and broad ridges, generally mixed with other assessment types, including subalpine forests and sagebrush shrublands. Curl-leaf mountain mahogany is the dominant shrub on most sites. On carbonate soils, little leaf mountain mahogany occurs. Mountain mahogany dominates less than five percent of the forest. Due to the steep, rocky nature of the mountain mahogany ecosystems, human use in these areas has been and continues to be relatively limited. Mineral development, roads, and dispersed recreation are the primary factors affecting the condition of this ecosystem on the forest. The photo below shows a patch of mountain mahogany. In the photo, tall (more than five feet) mountain mahogany shrubs occur in a line along the moderately sloping (about 30 percent) ridge in the back. The shrubs are umbrella-shaped, with multiple stems and olive green leaves. In the foreground, an opening between the mahogany shrubs contains interspersed rocky openings with low growing sagebrush and native herbs and grasses with a cover of about 20 percent.

Mountain mahogany patch on the Inyo NF

Subalpine Forests and Alpine

Subalpine forests occur in patches with alpine vegetation, meadows, and sparsely vegetated talus slopes and rock outcrops. Whitebark pine, limber pine, foxtail pine, Great Basin bristlecone pine, lodgepole pine, western white pine, and mountain hemlock are common species. Subalpine forests cover nearly 20 percent of the forest across the higher elevations of all of the mountain ranges. A prolonged winter snowpack, a short growing season, and cold winter temperatures are characteristic. The iconic alpine areas occur at the highest elevations of the Sierra Nevada and White Mountains, almost all in designated wilderness.

Among the subalpine conifer forest types, the Great Basin bristlecone pine is especially noteworthy. Known for being the oldest living trees on the planet, the bristlecone pines are afforded extra protection on the Inyo NF within the congressionally-designated Ancient Bristlecone Pine Forest, a special interest area managed to protect the bristlecone pines for public enjoyment and scientific study. Whitebark pine has recently been listed as a candidate species by the U.S. Fish and Wildlife Service, indicating concern for the long term viability of this keystone species. This is due primarily to the widespread mortality occurring across much of its range due to white pine blister rust (WPBR) and other causes, as well as projected trends. WPBR is a non-native pathogen causing substantial mortality of whitebark pine in other parts of its range. Mountain pine beetle, a native insect, is the agent currently affecting whitebark pine on the Inyo NF. Mortality currently occurring on the Inyo NF may continue to spread in the coming years. There is high vulnerability to climate change in subalpine conifer forests, including bristlecone pine (Meyer 2013b). Movement of pinyon pine up into bristlecone pine forests has been observed (Slaton 2013).

The photograph below shows a typical alpine/subalpine landscape on the Inyo NF. In the front half of the photo, a reddish, rocky talus slope is interspersed with a variety of low growing alpine flowering plants. A few, scattered, stunted subalpine conifers are interspersed. In the background, a large reservoir sits in a glaciated, open, rounded basin. On the far slope, a low cover of dark green, low-growing subalpine conifers cover the rocky slope rising up from the lake. In the distance, a tall, flat-topped peak has no conifers and the appearance of no vegetation. It is likely covered with very low-growing, hardy alpine plants, hiding between the rocks for protection from the cold, harsh winds.

Picture of alpine/subalpine at Saddlebag Lake

Natural Range of Variability

Comprehensive, scientific literature reviews on natural range of variability were compiled. The following is an overview. The Inyo NF Chapter 3 topic paper contains additional information regarding natural range of variability.

Terrestrial ecosystems in the Inyo NF are partially outside the natural range of variability for key indicators of ecological function, structure, and composition.

For example, the Jeffrey pine and mixed conifer assessment types are considered to be strongly departed, with fires occurring less frequently now than during the historic period. Subalpine forests are thought to have a current fire regime similar to the pre-settlement fire regime. The extent of departure in sagebrush ecosystems is the subject of current debate in published literature, and is highly specific to sagebrush species and location. In general, low and black sagebrush are not strongly departed from historic conditions, and more mesic, whereas moist sites of mountain big sagebrush are departed, having missed one or more fire cycles. Xeric shrublands and the xeric shrubland-sagebrush interface are probably experiencing more frequent fire now than they did historically. This is of special concern due to the vulnerability of these areas to cheatgrass invasion following fire.

A longer fire season, associated with earlier drying of fuels, has resulted in increases in the size and intensity of wildfires across the western United States and the Sierra Nevada (Jardine and Long 2013). An overall lengthening of the fire season has been evident in some significant fires on the Inyo NF over the last decade, especially in xeric shrublands and blackbrush. High annual grass cover, coupled with low winter precipitation and strong winds have resulted in recent fires during the winter and spring months.

Forest ecosystems, including Jeffrey pine and mixed conifer forests, and meadows of the Inyo NF are experiencing increasing tree densities and canopy cover that likely exceed the natural range of variability (NRV) (Gross and Coppoletta 2013, Safford 2013). Tree densities are also increasing in high elevation subalpine forests, based on information immediately northwest of the Inyo NF (Dolanc et al. 2013). There is evidence for increased growth rates and some subalpine tree expansion into mesic alpine environments at tree line, although patterns are species-specific (Meyer 2013b). Likewise, montane meadows and aspen stands are experiencing increased conifer density and cover over the past several decades (Estes 2013a, Gross and Coppoletta 2013). Some montane meadows on the Inyo NF have experienced a decline in willows and lower vascular plant taxa coincident with intensive sheep grazing in the late 19th century (Dull 1999). Subalpine forests and alpine vegetation are probably within NRV with respect to species composition (Dolanc et al. 2013).

A combination of factors including fire suppression, grazing, and warming climate conditions has favored the encroachment of Pinyon-juniper woodlands into sagebrush, especially in relatively mesic sites characterized by deeper soils and more gradual topography. Heavy livestock grazing that started in the 1860s resulted in the loss of native perennial grass cover, which in turn may have reduced herbaceous competition and altered the historic fire regime and further promoted Pinyon pine encroachment into sagebrush ecosystems. Similarly, Jeffrey pine has also encroached into sagebrush ecosystems in limited portions of the forest, possibly due to fire suppression. Sagebrush, pinyon-juniper, xeric shrubland, and mountain mahogany ecosystems on the forest are experiencing increased densities and cover of invasive plant species, especially cheatgrass, corresponding with the loss of native herbaceous plant cover (Slaton and Stone 2013b).

Terrestrial ecosystems of the Inyo NF are expected to experience dramatic changes in climate in the coming decades (Mallek and Safford 2011, Safford et al. 2012b). Expected climatic conditions by the middle of this century have not occurred over the last 12,000 years, or at any time during which humans have inhabited the western United States. However, some warmer periods that occurred in the past do provide high quality information regarding expected changes in ecosystem structure and composition that will accompany climate change. Indeed, many of these changes, especially related to trends in fire and insects and disease, are already evident.

Over 205,000 acres on the Inyo NF have experienced some level of tree mortality caused by native forest pests over the past ten years (Forest Health Monitoring 2002-2012), two-thirds of which were solely pinyon ips beetle, followed in extent by Jeffrey pine beetle and mountain pine beetle. Conifer mortality associated with insects tends to increase whenever annual precipitation is considerably less than historical average. Trees stressed by inadequate moisture levels have weakened defense systems, leaving them highly susceptible to attack by bark, engraver, or wood-boring beetles. High levels of conifer mortality have been recorded in association with extreme or protracted droughts in the Sierra Nevada range.

Changes in species distributions are expected to continue over the upcoming planning period, primarily as a result of climate change and potential changes in fire regime. Because populations react to environmental change individualistically, new ecological communities may emerge which have not existed in the past and do not occur today (Jackson et al. 2009, Wiens et al. 2012, Williams and Jackson 2007). Many data sources point toward increasing frequency of debris flows, and weather events associated with increasing temperatures and changing amounts and seasonality of precipitation. (Thorne et al. 2013) evaluated future climate exposure to vegetation using downscaled climate projections for the southern Sierra Nevada, including the Inyo, Sequoia, and Sierra National Forests, excluding the White and Inyo Mountains. Their results indicate a high proportion of all terrestrial ecosystems in the southern Sierra Nevada will be moderately, highly, or extremely vulnerable to future climate by the end of the century. This was especially apparent in mid to high-elevation forest ecosystems, including Jeffrey pine, mixed conifer, red fir, subalpine, and aspen. Alpine environments are also highly vulnerable to climate change, with projected range contractions exceeding 50 percent in the southern Sierra Nevada (Lenihan et al. 2003). Using a similar modeling approach, Neilson et al. (2005) projected a decline in sagebrush habitat and eventual replacement by Mojave Desert species, such as creosote bush. Pinyon-juniper woodlands may expand upslope on the Inyo NF with climate change, but model projections also suggest a decline in overall distribution of this vegetation type within the second half of the 21st century (Finch 2012). Bioclimatic envelope models also project a decrease in cheatgrass distribution and increase in red brome and spotted knapweed invasions in eastern California, including many parts of the Inyo NF (Bradley 2009). However, the degree of cheatgrass geographic range contraction on the forest is contingent on decreases in summer precipitation and increases in winter temperature.

Vegetation Diversity: Plant Communities and Uncommon Species

The Inyo NF has a particularly diverse assemblage of plant communities because of its proximity and overlap with the Sierra Nevada, Great Basin, and Mohave Desert. The diversity of vegetation types on the Inyo NF supports a variety of rare or uncommon plant species. In addition to the more broadly distributed habitats described above, aspen communities, alkali flats, dry forb communities, and areas with carbonate soils were identified as unique terrestrial communities. These “special habitats” are described in a later subsection of this chapter, and carbonate areas are discussed in the Inyo NF Chapter 15 topic paper.

Vegetation Diversity: Type

There are two different maps of vegetation that are shown below for the Inyo NF. Both are useful. The first is from the Terrestrial Ecological Unit Inventory (TEUI). It was developed using photo interpretation and verification of a selection of the polygons on the ground. The scale of the areas mapped is broad, with no area fewer than five acres in size drawn. Most of the areas are much larger than that. It often contains mosaics of two or more vegetation types that occur together. Because this map has been extensively field verified and is most often used for vegetation analyses for forest projects, it was relied on strongly throughout this assessment. The other map is of the California Wildlife Habitat Relations (CWHR) types and is based on satellite imagery. This map is available for all forests in the Forest Service Pacific Southwest Region, and is therefore an important tool that enables region-wide analyses and some comparisons between forests. The vegetation types are more general but the size of area distinguished is smaller - a minimum of 2.5 acres. These differences in approach between maps can lead to differences in summaries that are developed from them. This is particularly true in areas with mixtures of pinyon-juniper and sagebrush, in open subalpine forest, and in patches of forest interspersed with more open rocky areas. The table below displays the approximate proportion of area depicted in each map. Rather than simply presenting conflicting information, different data sources, such as these, highlight those areas where additional information may be useful, especially, for example, in east-side systems, including sagebrush and pinyon-juniper.

In this table, the left column lists the dominant vegetation types. These include: xeric shrubland, sagebrush, pinyon/juniper, Jeffrey pine, mountain mahogany/chaparral, mixed conifer, red fir, subalpine, alpine, sparsely vegetated, aspen/riparian, and meadow. The middle column displays the approximate percent of area according to the CWHR satellite-based map. The right column shows the approximate percent of area according to the TEUI, photo-interpreted based map. The amount of xeric shrubland ranges from eight percent in the CWHR map to 11 percent in the TEUI map. Although individual levels of sagebrush vs. Pinyon/juniper types differ between the maps, the combined amounts are about 45 percent on both maps. Similarly, mountain mahogany or chaparral, and mixed conifer are similar at four percent and two percent respectively.

Dominant vegetation types with CWHR and TEUI

Dominant Vegetation Type	Map (Information Source)	
	CWHR (satellite)	TEUI (photo interpretation)
Desert scrub/Xeric Shrubland and Blackbrush[a]	8%	11%
Sagebrush (and grass)	31%	17%
Pinyon Juniper	15%	28%
Jeffrey Pine	4%	7%
Mountain Mahogany/Chaparral	3%	4%
Mixed Conifer	2%	2%
Red Fir	1%	6%
Subalpine Forest	13%	19%

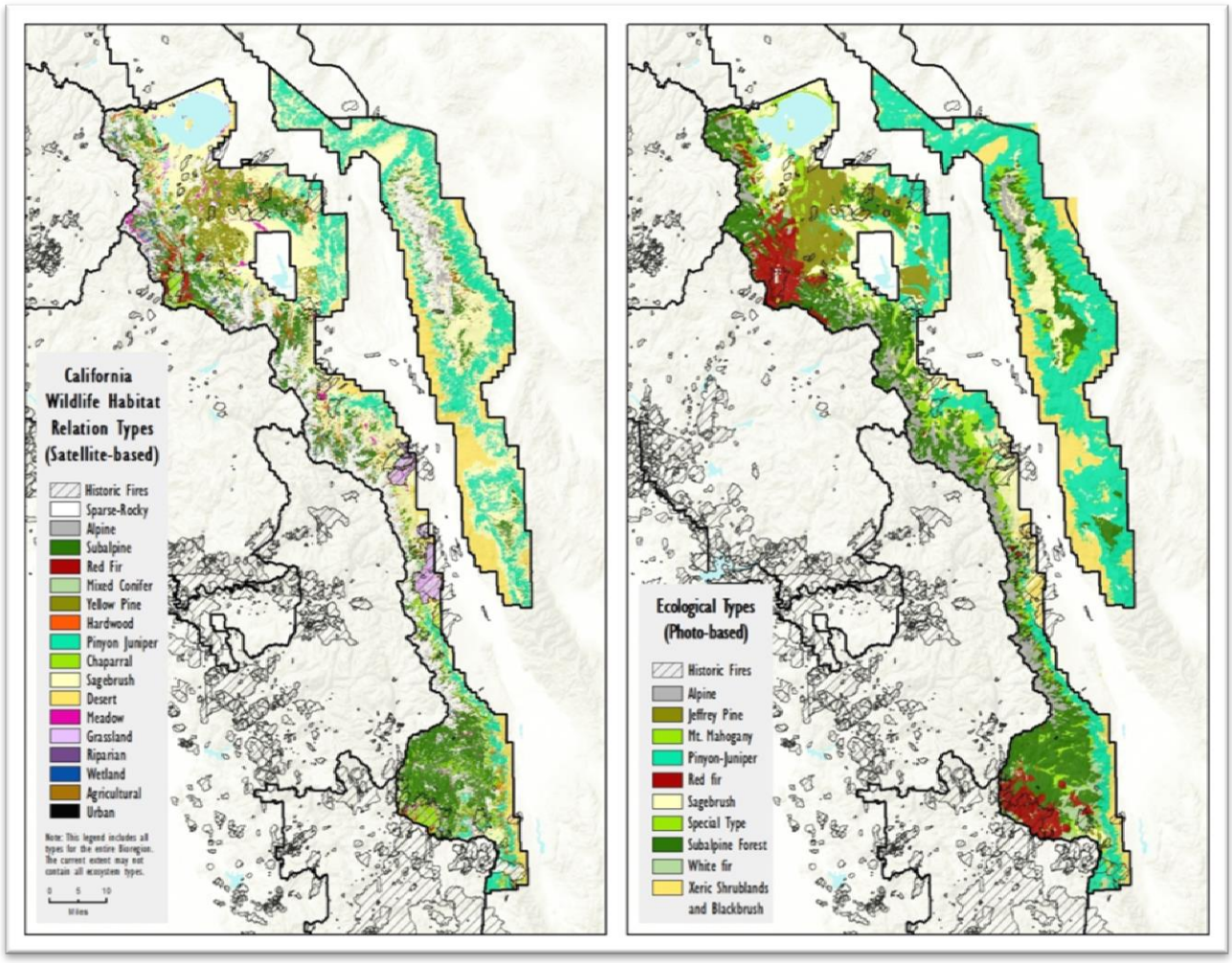
Dominant Vegetation Type	Map (Information Source)	
Alpine	3%	6%
Aspen/Riparian	2%	2%[b]
Meadow/Wetland	2%	1%[b]

[a] At this broad scale in these datasets, different names were used to describe similar vegetation types. Specific crosswalks are available on request.

[b] The aspen dataset used in the Inyo NF Chapter 1 topic paper was derived from a finer scale analysis on the forest which used the TEUI and other data sources. Similarly, the meadow dataset was uniquely derived, and excludes woody riparian areas, and dry alpine fellfields.

The maps below show portrayals of existing vegetation from the two mapping efforts. The map on the left is from the CWHR and the map on the right from the TEUI. Both show the same colors for the vegetation types listed in the table above as follows: alpine as gray; Jeffrey pine (TEUI) or yellow pine (CWHR) as olive green; mountain mahogany (TEUI) or chaparral (CWHR) as light green (only on TEUI map); pinyon-juniper as aqua blue; sagebrush as light yellow; desert (CWHR) or xeric shrublands or blackbrush (TEUI) as tan; subalpine forest as dark green, white fir (TEUI) or mixed conifer (CWHR) as gray green; red fir as maroon; and on the CWHR maps on grassland as lilac (in recently burned areas); meadows as pink; and on both black side lines, burned areas.

There are many similarities in overall patterns on the maps, although the level of detail in polygons differs. Both maps show the band of the forest on the east, the White and Inyo Mountains, with dominantly pinyon-juniper (aqua) across most of the middle of the area, but with a center stripe of dark green (subalpine forest, mostly bristlecone pine), adjacent to a high elevation sagebrush strip in the middle. Along the lower edges of the White and Inyo Mountains, both maps show a band of xeric shrubland and blackbrush, mostly on the western, lower slopes that border Owens Valley. The polygons on the TEUI map are more generalized, reflecting the photo-interpreted basis, while the polygons on the CHWR map are more pixelated, reflecting the satellite-basis. The western strip of the forest, along the western escarpment of the Sierra Nevada is similar but shows more differences. On either end of the band of forest, the Kern Plateau on the south end, and the Reds Meadow Valley on the north, the TEUI map shows large patches of maroon, red fir forest, while the CWHR map shows small interspersed patches. This is due to differences in defining forest types and detection differences. Adjacent to these areas and along the crest of the Sierra Nevada, both show a long band of subalpine forest (dark green), interspersed with alpine (gray) types. Mono Lake sits at the northern-most edge of the Inyo NF on this western band. Both maps show a large patch of Jeffrey or yellow pine (olive green) in the northern quarter of this band, below Mono Lake. To the east and south, along the lowest elevations, both maps show patches of pinyon-juniper, and in between in some areas, sagebrush. The CWHR map shows more sagebrush, particularly in the northern third, which results from difficulty in satellite-based detection of forests with open tree cover, which is so common on the Inyo NF. Both maps show desert or xeric shrublands below the pinyon juniper, on the southern quarter of the forest.



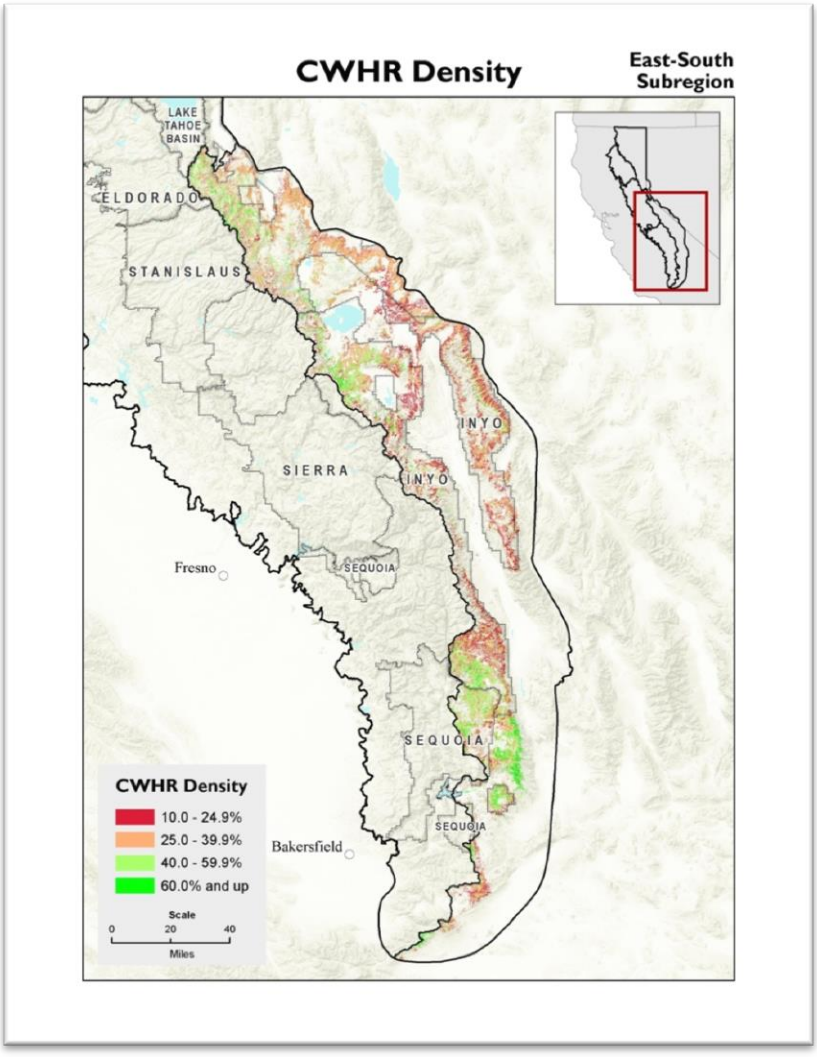
Range of California Wildlife Habitat Relationship Types
based on dominant species or vegetation type on the Inyo NF

Complicating patterns of sagebrush is the expansion of pinyon-juniper. Approximately 25,000 acres on the forest are currently occupied by pinyon-juniper woodlands including sagebrush shrub communities that have experienced an increase in pinyon and/or juniper trees over the past several decades or longer due to natural and anthropogenic causes.

In addition to dominant plant species, the size and density of vegetation is important for wildlife habitat and conditions relative to the natural range of variability. For forests and woodlands, the CWHR size (average diameter), and density (canopy cover) were summarized. These datasets are frequently used for regional and forest-wide summaries. However, because they are based on a limited number of plot samples, the datasets are generally not used for project-level analyses. For more detail on the CWHR for forested types, see the July 18, 2013 snapshot of the Bio-Regional Living Assessment, Chapter 1. Similarly, for seral stage, which also reflects size, see the Inyo NF Chapter 1 topic paper. These classifications of size and stage of development have not been well developed for non-forested types and will not be covered here.

The map below displays the spatial patterns and extent of different CWHR density classes. It shows area, with national forest boundaries in dark gray. The CWHR density represents four different tree canopy cover

classes. These are: sparse (1-24 percent cover) shown as light red; low (25-39 percent cover) as maroon; moderate (40-59 percent cover) as light green; and dense (greater than 60 percent cover) as darker green. Most of the forest is covered in woodlands or open forest with less than 40 percent cover. This reflects the dry conditions east of the rain shadow of the crest of the Sierra Nevada. Two exceptions are the Reds Meadow Valley and the Kern Plateau, where some areas of moderate and even dense tree cover occur. These are visible as two large, round areas just west of the Sierra Nevada crest on the western side of the forest, located in one patch on the north (Reds Meadow), and one on the south (Kern Plateau). There are also large extents with mapped with no trees or sparse trees (less than 25 percent cover), particularly as long bands along the eastern mountains of the forest (Inyo and White Mountains) and in the center along the eastern Sierra escarpment below Mount Whitney and the highest peaks.



Spatial patterns and extent of different CWHR "density" (canopy cover) classes on the Inyo NF

Vegetation Diversity: Large Trees and Snags

Large trees and snags are important to numerous cavity nesting and foraging animals including marten, goshawk, woodpeckers, and many cavity nesting birds.

Large tree densities were estimated from the Forest Inventory and Analysis (FIA) plot data and include means, medians, and the coefficient of variation (COV). The coefficient of variation (COV) is a measure of how variable the densities are. Sometimes trees are concentrated in patches and sometimes absent. The median is the middle value and is more useful than a mean when the item being summarized is patchy, like large trees or snags. Detailed tables on the large tree estimates can be found in the Bio-Regional Living Assessment Chapter 1, line 523. Key findings are presented here.

Jeffrey pine forests had highly varied large trees, with median tree densities of 5, 4, and 1 for large trees greater than 21, 24, and 30 inches respectively. The COVs all exceeded 100 percent, indicating a high level of patchiness. Once again, a few pines greater than 40 inches were noted but were very scattered, possibly due to historic removal of large diameter trees. Moving up in elevation and moisture levels, red fir had the highest densities of large trees, as well as the largest trees. Median levels of large tree density in red fir were 20, 15, 10, and 3 per acre for trees greater than 21, 24, 30, and 40 inches in diameter respectively. A few scattered trees greater than 50 inches diameter were noted. The COV was lower for the most part, with levels less than 50 percent for trees 21, 24, and 30 inches or more. Lodgepole pine, which is a common subalpine type, and mixed subalpine forests, had large trees represented in all large tree sizes, with higher densities of trees less than 40 inches but some trees up to 50 inches in size. In lodgepole pine, median densities were 15, 8, and 3 trees per acre for trees greater than 21, 24, and 30 inches in diameter respectively.

Densities of snags greater than 15 inches follow similar patterns by forest type but with lower levels. Median densities (number per acre) followed by COVs in parentheses were as follows: 1.2 (158 percent) in aspen; less than 0.1 (277 percent) in Jeffrey pine; less than 0.1 (234 percent) in pinyon-juniper; 1.8 (109 percent) in red fir; 0.3 (85 percent) in mixed conifer; 1 (139 percent) in lodgepole pine; and 4 (152 percent) in subalpine. These high COVs is typical for snags which are usually very patchy. It is unknown how these levels differ with historic levels prior to fire suppression and logging, which primarily affect the Jeffrey pine forest.

Vegetation Diversity: Within Stand and Landscape Structure

Heterogeneity is a term used to describe variable or patchy vegetation. North et al. (2012) consider restoration of forest heterogeneity a major management goal. There has been less discussion of heterogeneity in non-forest vegetation types. Previous discussion of increased forest density and lower large tree levels support the research that forests have become more uniform on the west side (North et al. 2009a) and to a lesser extent in east side forests (Safford 2013). Jeffrey pine forests in San Pedro Martir in Baja California where fire suppression was absent until recently, have been suggested as one possible reference for restoration in eastern forests in California with similar climate (Safford 2013, Stephens et al. 2007).

North and Sherlock (2012) suggest using the coefficient of variation (COV) of stand structures as a way to measure the amount of “structural heterogeneity”. Using Forest Inventory and Analysis (FIA) data from the Inyo NF, the variation in basal area - the total cross-sectional area at 4.5 feet height of all trees - was calculated between the four subplots that comprise each FIA plot. Thirty percent of the Jeffrey pine plots supported COVs in basal area that were greater than or equal to 100 percent, which is a general standard for identifying datasets with high heterogeneity/variance (Sokal and Rohlf 2012). Half of the aspen stands were heterogeneous (COVs greater than 100 percent). Otherwise, less than ten percent of the other forest types

showed marked heterogeneity. Little research has been conducted on what comprises heterogeneity in forests and what the implications are for biodiversity and ecosystem function. However, there some general observations can be made.

Historically, yellow pine forests consisted of relatively open, patchy stands composed of primarily large, fire-resistant trees, with a high degree of spatial complexity that included patches of shrubs and relatively dense even-aged stands (Collins and Skinner 2013). Currently higher tree densities and smaller average tree size have reduced heterogeneity (Collins and Skinner 2013, Van de Water and Safford 2011). Subalpine forests are naturally patchy because of the interspersion of alpine or rocky patches.

Heterogeneity at the landscape scale is difficult to quantify, and this was identified as a gap needing further information in the Inyo NF Chapter 1 topic paper. Two approaches were examined. The first was a summary of heterogeneity of seral stages across the landscape, which was included as a part of the development of the TEUI dataset. Using this method, sagebrush shrublands were found to have the greatest proportion of early and mid seral habitat, as compared to other assessment types, which has resulted from some large fires in that type. Notably, all other assessment types were estimated to have less than ten percent early or mid seral communities. The second measure of landscape level structural heterogeneity was derived from the TEUI dataset. This dataset contained specific rule sets that enabled summaries of approximate patch size of existing vegetation types in areas with mixed vegetation. Using this method, heterogeneity was found to be generally high across the forest, resulting from steep elevation gradients, and high variation in slope, aspect, and substrate. Pinyon-juniper and Jeffrey pine were found to have lower landscape level heterogeneity, with large, continuous areas mapped with little variation in composition or structure. Subalpine forests were found to be highly heterogenous, with large areas mapped as patches less than five acres, mixed with other vegetation. Mountain mahogany was also found to have higher heterogeneity, with large expanses mapped as 5-40 acre patches mixed with other vegetation.

Special Habitats

There are some habitats that are less common, yet support a high level or specialized type of biodiversity. Although numerous unique areas and communities are found on the forest, a subset was selected for which the effects of past and current management actions are best understood, and for which drivers and stressors are expected to bring ecological change over the next few decades. While not an exhaustive list, the special habitats noted on the Inyo NF include alkali flats, dry forb communities, and aspen. Aspen supports a high level of plant biodiversity, with many wildlife species utilizing aspen stands during some stage of their life cycle (Kuhn et al. 2011). Aspen occurs at moderate to high elevations on the Inyo NF across a little over 24,000 acres and is present in every eco-region except the Inyo Mountains. It occurs where there is some source of moisture, either from subsurface or surface water and its life cycle is closely tied to fire (Estes 2013a). Based on surveys of aspen on the Inyo NF, over 40 percent are at moderate to high risk of loss. Poor regeneration due to conifer encroachment and disease are the primary recorded factors. Conifer encroachment is due mostly to fire suppression, since fire favors the sprouting aspen and kills young conifers (Estes 2013a). Climate change may also be a factor, as noted in the Rocky Mountains, but it has not been investigated here (Estes 2013a).

Estimates suggest that aspen extent in western North America has been reduced by as much as 96 percent, primarily because of fire suppression and historic overgrazing. Warmer and drier conditions that have developed over the last 12,000 years have probably also contributed to the reduced distribution of this moisture-dependent species. Fire is important in aspen stands because it kills young conifers that shade out

light-loving aspen. Grazing by domestic livestock, sheep and cattle increased dramatically in the mid-1800s and had a dramatic effect on aspen and meadows in general. Aspen sprouts, or regeneration, are favored browse. Fencing can result in higher aspen sprouts. In the intermountain west, decreased aspen growth has already been attributed to higher temperatures and extended drought. Annual fluctuations in available soil moisture resulting from El Niño influences on snow pack depth may have a significant influence on establishment of plants. Higher temperatures and earlier snowmelt appear as a trend outside the natural range of variability. Aspen are found associated with wet conditions, sometimes subsurface that cannot be seen. This is apparent when aspen occur separate from meadows or other riparian areas.

The Inyo NF conducted a survey of 139 aspen stands on the forest, representing ten percent of mapped stands. They were classified according to six categories of risk of loss, using the Forest Service aspen monitoring protocol (Aspen Delineation Project 2002). Out of the sampled stands, 14 percent were rated at high risk of loss, 27 percent moderate risk, and 58 percent as low or no risk. The primary underlying risk factors noted were conifer encroachment, poor regeneration, and disease. Estes (2013a) reported that fire has been the most consistent influence on the extent and health of aspen in the bio-region.

Sudden aspen decline, or SAD, is affecting many aspen stands across the western United States. It is characterized by sudden extensive stand mortality, little to no regeneration, and root death. To date, there is no clear evidence of SAD on the Inyo NF. Cheatgrass is the most common invasive plant species found in aspen stands on the forest. Other invasives of highest concern and known to occur within aspen stands include perennial pepperweed, spotted knapweed, lenspod whitetop and bull thistle. There are over 500 acres of non-native plant species recorded within aspen stands on the Inyo NF.

There are several other habitats that support unusual and sometimes rare species. These include dry forb communities and alkali flats. These are areas with unique soils and sparse vegetation, namely herbs and grasses. The pumice flats and the colluvial aprons are two distinct types of dry forb communities, and both provide habitat for rare endemic plant species found only in these habitats in these locations. The Mono milkvetch and Mono Lake lupine are both endemic to the pumice flats of Mono County, found only on the Inyo NF and neighboring lands. The California Natural Diversity Database tracks Mono pumice flats as a rare community. The Ramshaw Meadows abronia is found only on the sandy colluvial aprons in two meadows on the Kern Plateau.

Alkali flats occur in valley bottoms and depressions where water collects and evaporates leaving salt rich soils. Uncommon plants found in these habitats include Lemmon’s milkvetch, Inyo County star-tulip, Golden goodmania, and Alkali tansysage.

The two photos below show these uncommon, herb and grass dominated habitats. Alkali flat is shown in the first picture and pumice flat is shown in the second.

Alkali flat

Pumice flat

The first photo shows widely spaced, gray-green, low growing plants dominating the large, flat dry lakebed. In between, whitish, gray, cracked soil is seen. In the background, there are several, low, gently sloping, dark ridges, with barely visible snowcapped mountains in the far distance, and then a bright blue sky.

The second photo is looking north across Big Sand Flat, a pumice sand flat on Highway 120. In the foreground is the sensitive/SCC plant species Mono Lake lupine, mixed with the yellow hulsea and probably some low sulfur buckwheat shrubs. There are sagebrush widely scattered in the flat and probably Douglas sedge just in front of the ridge. The low ridges in the middle ground have scattered pinyon pine and more dense Jeffrey pine. The background is the Sierra crest north of Mono Lake with patches of snow.

Fire and invasive grasses are limited due to the harsh conditions. These delicate areas can be impacted by ground disturbance from people, livestock and vehicles.

Terrestrial Plant and Animal Diversity

A complete inventory of the number of plant species on the Inyo NF was not available. However, a database under development for eastern California shows that at least 1,300 vascular plant taxa are known from the eastern Sierra Nevada region, plus White, Inyo, and Glass Mountains, Owens Valley, and Crowley and

Mono Basin. Published floras for the White Mountains, Glass Mountains, and Mono Basin also list 1,078, 489, and 691 taxa from those areas, respectively (Honer 2001, Morefield et al. 1988, Schweich 2013). The Inyo NF is inhabited by approximately 300 species of terrestrial wildlife: 160 bird species, 100 mammal species and 30 reptile species. There are also ten amphibian species, some of which are terrestrial for at least part of their lifecycle. Chapter 5 of this assessment contains detailed information on species classified as federal threatened, endangered, proposed or candidate species under the Endangered Species Act. Species of conservation concern, their habitat, threats, condition, and trends are also covered in Chapter 5 of this assessment.

Connectivity

The ability for species to move throughout a landscape is important for ecological integrity. Species that are wide-ranging are able to maintain genetic diversity and sustainability in the face of changes to their population or environment. Existing information on connectivity across the Inyo NF and the bio-region include: California "essential connectivity project corridors"; the pine marten habitat connectivity assessment (Spencer et al. 2011); special management areas; old forest emphasis areas from the Sierra Nevada Ecosystem Project (SNEP) (Franklin and Fites-Kaufman 1996); and distribution of multiple wide-ranging species including the goshawk and deer. Deer migration corridors are covered in Chapter 8 of this assessment.

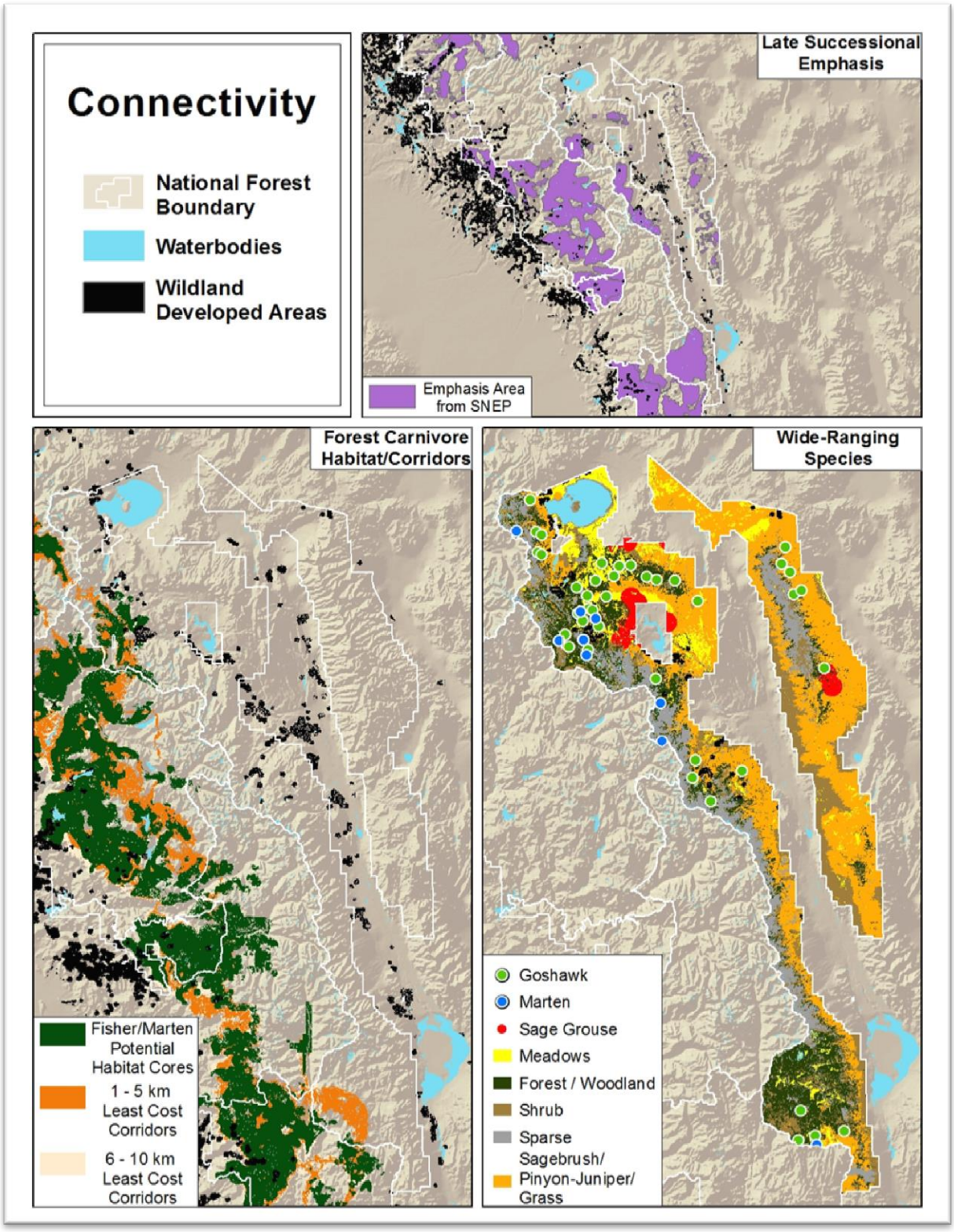
The Sierra Nevada portion of the Inyo NF is important for bio-regional connectivity for several reasons. First, the wilderness areas that cover most of this portion of the forest lie adjacent to Yosemite National Park, wilderness areas on the Sierra and Sequoia National Forests, and Sequoia-Kings Canyon National Parks. See Chapter 15 of this assessment for more information. This provides a large contiguous area where plants and animals can move and migrate freely. This will be especially important with climate change where migration of some species higher in elevation (Meyer 2013b) and north will occur and is already occurring.

The figure below shows three panels displaying key sources of information on connectivity. Each panel displays the Inyo NF. The boundary is depicted with a white line. The surrounding areas are draped over a topographically shaded relief map of the landscape.

On the top left panel is a legend with the following common map features: wildland developed areas, or where there are structures or infrastructure as large black dots; and large water bodies are colored light blue. The top right map is of late successional emphasis areas (ALSE). These are shown as purple areas and depict landscapes where older forest occurs in continuous areas or consistently across the landscape (Franklin and Fites-Kaufman 1996). Concentrations of old forest, or larger purple areas, occur in a number of places on the Inyo NF. The largest area is across the Kern Plateau, where 90 percent of the area is depicted in purple. Other large areas are on the top of the White Mountains, where the ancient bristlecone pine stands are found and subalpine and red fir forests at the higher elevations along the crest of the Sierra Nevada. These latter areas encompass about 20 percent of the area and are almost all in wilderness, except for the red fir forests in the Mammoth Lakes area. One large and several smaller patches of old forest are shown in Jeffrey pine, to the south of Mono Lake, in the Glass Mountains.

Below that are forest carnivore habitat areas and corridors (Spencer et al. 2011) on the left. Safe (least cost) corridors are in orange and pink and marten habitats are marked in dark green. These occur primarily in the Reds Meadow Valley and on the western quarter of the Kern Plateau. For the forest carnivore habitat / corridors map: fisher and potential fisher habitat are not found on the Inyo NF.

On the right, generalized locations of wide-ranging species including goshawk and marten, are shown. In the White Mountains, on the eastern third of the Inyo NF, there are several locations of goshawk in the northern third. Most of the goshawk sites are on the western portion of the forest, with several on the Kern Plateau, a few in the middle, and most in the Jeffrey pine and red fir forests in the Mammoth Lakes Basin and south and west of Mono Lake. There are relatively few marten. Most are in the red fir and subalpine forests in the Mammoth Lakes area, a few south of there are one known location in the southern end of the Kern Plateau.



Connectivity on the Inyo NF

Fire as an Ecological Process

Fire is a "keystone" ecosystem process in the bio-region and many ecosystems on the Inyo NF (McKelvey et al. 1996 vanWagtendonk and Fites-Kaufman 2006). This means that it is of key importance to ecosystem composition, structure, and function. The patterns and history of fire on the Inyo NF and in the bio-region are discussed in Chapter 3 of this assessment.

Recurrent fire has shaped ecosystems of the Sierra Nevada (Skinner and Chang 1996). Many of the plants have fire adapted or enhanced traits, such as thick bark and fire-stimulated flowering (Chang 1996, vanWagtendonk and Fites-Kaufman 2006). Aspen is a notable example. It sprouts following fire and regeneration mostly comes from sprouting. Currently, there are concerns about negative impacts of dense conifer cover around them, reducing their vigor, extent, and reproduction (USFS 2001). Highly variable fires maintained patchy or "heterogeneous" vegetation structure and composition (North et al. 2009b). This patchiness, along with enhanced plant growth from sprouting or fire-induced nutrient flushes, is thought to have provided diverse and productive habitat for many different plant and animal species. Animals currently associated with high density canopy, such as pine marten, may have previously been associated with more diverse vegetation that supported more prey, as well as cover. With fire suppression, this diversity has decreased. It is unknown how species would change with increased vegetation diversity (Zielinski 2013). Other landscape mosaics on the Inyo NF are strongly influenced by fire. The distribution of Pinyon-juniper and sagebrush ecosystems is an important example. Still other areas, especially xeric shrublands, are experiencing more fire than historically. The ecological implications of these changes differ depending on the ecosystem.

Jeffrey pine and mixed conifer forests historically had frequent fire (Safford 2013). These forests have experienced increases in tree density, and surface fuels that are thought to produce more high severity fire across larger areas than in the past. They are rated as highly departed from historic fire frequencies (Safford and Van De Water 2013).

The typically sparse fuels make fire uncommon in mountain mahogany (Riegel et al. 2006). It is a weak sprouter and mostly regenerates by seed. Fires are burning somewhat less frequently than they did historically, due primarily to fire suppression (Safford and Van De Water 2013).

Red fir on the forest has missed some fire cycles but the amount and ecological effects depend on the landscape the stands occur in. Isolated stands, surrounded by sparse vegetation or rock, have been found to have longer intervals between fires. These areas have missed few fire cycles and experienced few ecological changes. Increased fuel loading, higher stem densities, less light in the understory, and reduced shrub cover are evident in these areas (North 2013).

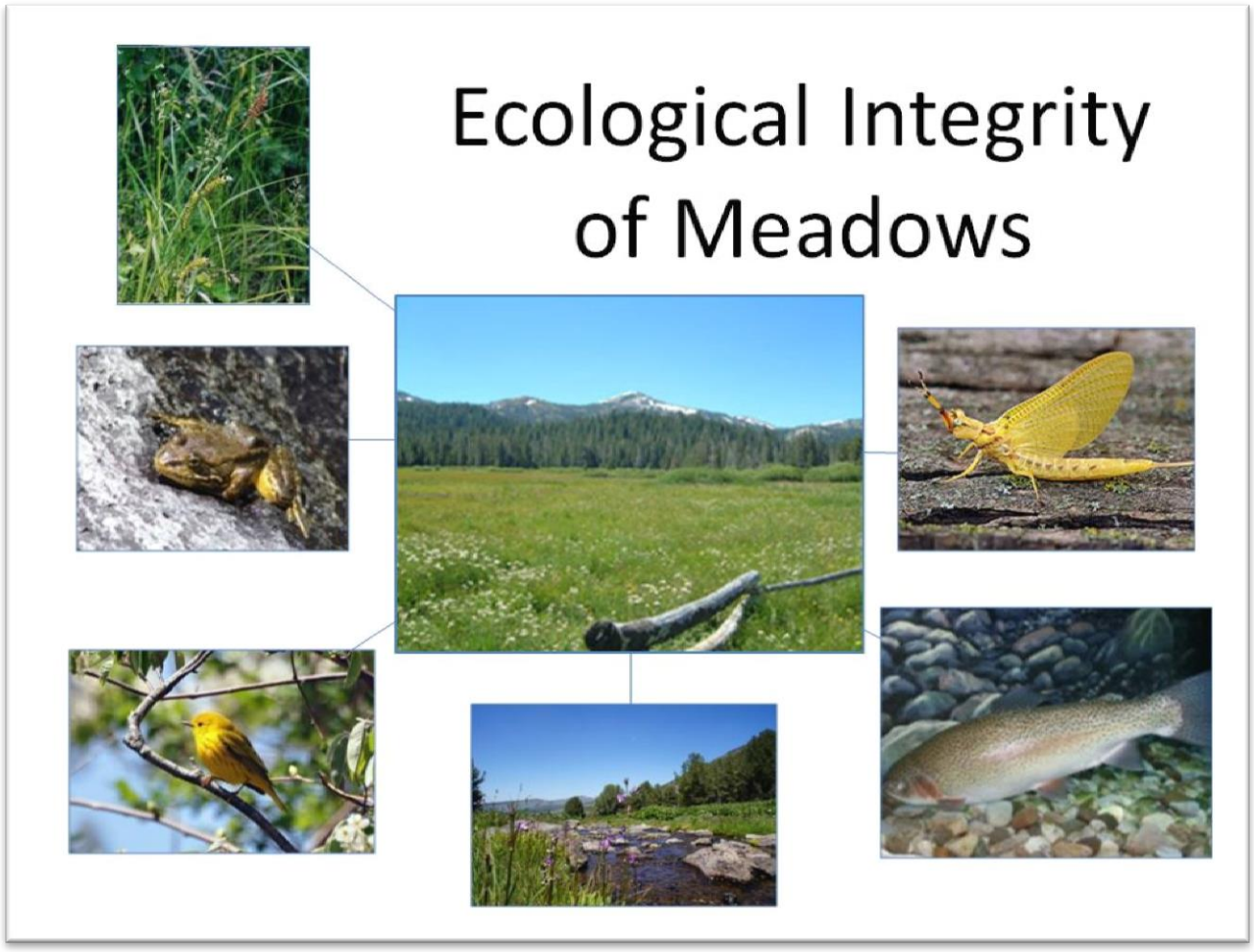
In contrast, xeric shrublands are experiencing more fire than historically (Brooks and Minnich 2006). The invasion of non-native annual grasses is shortening the fire return interval. Some ecosystems with very sparse vegetation, such as alkali flats, have always had little fire.

More detailed information can be found in the Inyo NF Chapter 1 topic paper and in the Natural Range of Variability Literature Reviews (Meyer 2013a, b, Safford 2013, Slaton and Stone 2013a, b). In addition, Chapter 3 of this assessment discusses the fire-related datasets available for analysis.

Aquatic and Riparian Ecosystems

Aquatic, or water-based ecosystems, and riparian based ecosystems in the water-land interface are closely linked. Hydrologic and biological cycles connect them. Riparian plants are influenced by levels and timing of water in the aquatic ecosystems. Aquatic ecosystems are affected by shade from riparian plants and nutrients from the leaves that fall into water. The following is a discussion of their connections, the integrity of aquatic ecosystems, and then riparian ecosystems. In the last section on sustainability, they are considered together.

The figure below illustrates the linkages between ecological elements of riparian and aquatic ecosystems in meadows of the Sierra Nevada bio-region. In the center of the figure, a picture of a wet meadow is shown. The foreground has a dense carpet of lush, green sedges and scattered white wildflowers. The background shows a low ridge with forest and a snow-covered mountain peak behind it. Surrounding this photo is an array of the biodiversity that occurs in the water, in the meadow or both. Moving clockwise around the photograph of the meadow, on the right there is a picture of a bright yellow aquatic insect, a mayfly, with large wings. It lives in the water part of its life and riparian area part of its life. Below that is a picture of a large rainbow trout, over a bed of gravel in a stream. The trout lives in the water but depends in part on insects for food, like the mayfly that lives at least part of its life in riparian areas. Below the meadow is a picture of a stream channel. The meadow and other riparian vegetation are dependent on subsurface water that feeds the stream and water that floods over the banks of the stream into the meadow at times. When the channel drops down, or is “incised” it reduces the water source for the meadow and can disrupt habitat for all riparian species. To the left is a photograph of a bright yellow little bird, the yellow warbler. These birds eat insects that spend part of their life in the water, and use shrubs, that grow in the wettest parts of meadows for nesting and raising their young. They also use the shrubs to hide from predators. Above the bird is a photograph of a frog. Most frogs start as eggs in water and then move to adjacent riparian areas once they grow legs. They depend mainly on insects in water and riparian vegetation. Finally, above the picture of the frog, is a close-up of sedge and grass plants. These form the basis of the foodchain for meadow ecosystems. Meadows are comprised of specific grasses and sedges that need water. Not only do they provide food for insects or voles or deer, but they also are important in providing soil and streambank stability with their dense network of roots.



Ecological integrity of meadows

There are many factors that affect the ecological integrity of aquatic and riparian ecosystems. These include European settlement, grazing, roads, recreational use, fire, and especially climate. Since aquatic and riparian ecosystems are so tied to water, fluctuations in rain and snow are particularly important to their ecological function.

Aquatic Ecosystems

Aquatic ecosystems are characterized as lentic and lotic. Lentic ecosystems include lakes, ponds, tarns, lakes, springs and man-made lakes, or reservoirs. Lotic ecosystems include flowing water bodies, such as rivers, creeks, and streams. Streams in meadows will be covered in the following section on riparian ecosystems.

Lotic Ecosystems

Large rivers are predominately absent from the eastern Sierra Nevada mountains. There are several along valley bottoms including the upper Owens River, the South Fork of the Kern River, and the San Joaquin River. There are many larger and smaller, sometimes seasonally flowing streams. Larger streams include

Pine Creek, Bishop Creek, Big Pine Creek, and Rock Creek. An estimated 1,640 miles of perennial streams are on the Inyo NF, as defined by the U.S. Geological Survey.

The eastern side of the Sierra Nevada lies in the rain shadow of these mountains, which reach their highest elevations on the Inyo NF. This has created a dry and precipitation-dependent and driven aquatic system. Streamflow is dependent on total precipitation and timing of snowmelt. Water flows can vary greatly from one year to the next, depending on precipitation levels. Some years, streams can be completely dry. Climate change is likely to magnify these shifts in two ways: with decreasing precipitation resulting in more dry years, and with earlier snowmelt and shifts in seasonal timing of flows (Hunsaker and Long 2013). The rain-snow interface zone is predicted to occur at higher elevations, causing warming of streams earlier in the season. Rivers in valleys usually provide a consistent, abundant flow of water throughout the year, and support more complex faunal ecosystems. For example, historically, the Owens River supported a guild of five different slow-water fish species, including the Owens tui chub, Long Valley and Owens speckled dace, Owens pupfish, and Owens sucker. Currently, the Owens River supports a diversity of introduced game fish, including rainbow and brown trout, and bass and catfish in some of the reservoirs.

Many of the stream systems on the Inyo NF were fishless prior to stocking of non-native trout, except the South Fork Kern River and Golden Trout Creek and their tributaries, which are the native range of the California golden trout. Native species found in these systems include a variety of stream-dwelling macro-invertebrates, or the aquatic life-cycle stage of many aquatic insects, such as caddis flies, mayflies, and stone flies. A variety of management and uses on the Inyo NF can impact ecological integrity of streams including: recreation, dams or diversions, grazing, road density, vegetation management, and ski areas. The impact depends on the proximity to the stream, intensity and timing.

Lentic Ecosystems

Lakes on the eastern side of the Sierra Nevada Mountains range in size from one acre to hundreds of acres. No lakes occur in the White Mountains, Inyo Mountains or Glass Mountains. Approximately 479 lakes that are greater than two acres in size occur on the Inyo NF, totaling about 46,000 acres. Historically the lakes of the high Sierra Nevada were fishless and supported native fauna such as amphibians, aquatic insects, abundant zooplankton and phytoplankton. The Mountain yellow-legged frog was an abundant resident of these lakes, with a life cycle that accommodated the seasons of ice in the high country (Knapp et al. 2007). Currently, many of the high elevation lakes support introduced trout species of brook, brown, rainbow and golden trout, which has had an impact on frog populations (Knapp et al. 2007; Knapp and Matthews 2000a, Knapp and Matthews 2000b). The historic introduction of trout into lakes throughout the Sierra Nevada mountain range has had the effect of eliminating the mountain yellow-legged frog from over 95 percent of its historic range (Vredenburg et al. 2007). The introduction of trout into these lakes has also altered the life-cycle and reduced the population numbers of macro-invertebrates and zooplankton within the lake (Knapp 2005, Schindler et al. 2001). This reduction or elimination also affects the intensity of insect hatches, which has been shown to affect bird migration patterns. Birds such as the rosy-finch have depended on insect hatches from lakes in the Sierra Nevada Mountains during the time when they need to feed their young, thereby influencing the success of fledging their young (Epanchin et al. 2010). The trout are popular for recreational use, which is an important source of economic sustainability in the area. See Chapters 7, 8 and 9 of this assessment for more detailed information on the economic and social aspects of sport fishing. Climate change will disrupt habitat for lake associated species. Mountain yellow-legged frog populations are impacted by the fungal pathogen commonly referred to as chytrid fungus (Briggs et al. 2005, Rachowicz et al. 2006, Reeder et al. 2012) in addition to introduced trout, climate change and other stressors (Bradford

et al. 2011, Davidson and Knapp 2007). More information on their status and trend is in Chapter 5 of this assessment.

Numerous dams have created reservoirs for water storage and electricity generation on the forest. See Chapters 2 and 8 of this assessment. Where meadows have been flooded, they have reduced or eliminated habitat for the Mountain yellow-legged frog. Reservoirs are easily accessed for recreation by the public, and provide boat-launch areas. Reservoirs are where invasive species are most likely to become established because those invasive species can be introduced to these waters by boats or other equipment.

Ponds and other small water bodies, such as tarns and pools, occur throughout the higher elevations within the Sierra Nevada Mountains. For the purpose of this discussion, water bodies less than two acres were identified as ponds, of which there are 1,372 on the Inyo NF, with a total of 662 acres. Due to the shallow nature of these water bodies, they are characteristically warmer during the summer months than lakes or streams. These features provide breeding habitat for the Yosemite toad and Pacific chorus frogs, which prefer meadow edges without deep water or adjacent steep terrain (Davidson and Fellers 2005). Most ponds occur in wilderness areas in the Sierra Nevada portion of the forest. Little to no information is available on their condition or trend. Impacts have been observed, but not collected systematically, from recreation, grazing, or pack stock. Climate change is likely to impact ponds and small water bodies. Although some tend to dry each year, drying may increase, and higher temperatures result in algal growth. This may have long-term effects on local populations of Yosemite toad and other species that use the ponds, such as the small fairy shrimp. How long these species can persist without water in critical breeding ponds is unknown.

Springs are small areas of water that come to the surface, and are fed by groundwater (Sada and Pohlmann 2002). Their water temperature is relatively constant and provides the only water over vast areas. Because of this, they are usually 'biodiversity hotspots', supporting many species that only occur there. Little information is available on springs and seeps on the Inyo NF. Springs are scattered throughout the Inyo NF, throughout different habitats. Existing information indicates that there are approximately 1,472 springs on the forest. Currently, the Owens tui chub is exclusively restricted to springs and spring channels because of their separation from main stem systems that have been planted with non-native predatory fish. See Chapter 5 of this assessment for more information about rare aquatic species found in springs. Stressors on these systems include spring development, recreation use, concentrated livestock grazing use, diversions and unauthorized off highway vehicle use. Groundwater pumping can affect springs even miles away from the pumping source, causing springs to cease flowing. Many springs have been fenced from livestock use, and this is expected to improve function and condition of these springs. Even with predicted decrease in water throughout the area as a result of climate change, it is expected that springs will persist, but may be the only water sources available for animals. Springs could receive additional impacts from species such as mule deer, burros, wild horses, and other animals as other stream sources dry, especially in the White and Inyo Mountains and Pizona area.

Invasive Species: Fish, Amphibians, Snails

The presence of reservoirs and their use as highly desired fishing locations also provides a vehicle for the introduction of several invasive species, such as the New Zealand mud snail, zebra and quagga mussels, and California salamanders, which was brought into the area as bait. The New Zealand mud snail has caused significant disruptions in stream food chains. Zebra and quagga mussels have not yet been observed on the Forest, although "infected" boats have been denied access to reservoirs in the area.

The presence of reservoirs and their use as highly desired fishing locations also provides a vehicle for the introduction of several invasive species, such as the New Zealand mud snail, and zebra and quagga mussels. The New Zealand mud snail has caused significant disruptions in stream food chains throughout the western states (Moore et al. 2012). Currently, there are only a few sites where aquatic invasive species are known to occur on the Inyo NF and vicinity. The New Zealand mudsnail *Potamopyrgus antipodarum* has been observed in the Owens River at the mouth of and below the confluence with McLaughlin Creek. The Asian clam *Corbicula fluminea* occurs in Indian Creek on the Toiyabe National Forest in Nevada. The native and sometimes nuisance freshwater alga species *Didymosphenia geminata* has been observed in Lee Vining Creek and Hilton Creek, tributary to Lake Crowley, but there have been no reports of it reaching nuisance densities. No systematic surveys have been conducted for aquatic invasive species and trends are unknown.

Ecological Integrity

There are several aspects of aquatic ecosystems that are outside the natural range of variability across some of the Inyo NF. First, where water development has occurred, habitat has changed. Second, climate is a strong driver of aquatic ecosystems. Changes in climate that affect the quantity, quality, or seasonality of water, can have significant impacts on the integrity of these systems. Warming temperatures, particularly if combined with less precipitation, could result in loss or change in aquatic ecosystems, depending on the direction and magnitude of climate change. There have already been changes in timing of snowmelt that is influencing stream flow patterns (Hunsaker and Long 2013). The many demands on water for human uses, such as hydropower, domestic water supply, and recreation, are likely to go up with increasing human population, placing additional demands on an already scarce supply. Non-native, introduced or invasive species have affected native animals. Mountain yellow-legged frogs have declined due to multiple factors including the non-native chytrid fungus and introduced trout. There are unknown levels of impact from historic and current forest uses including recreation, agriculture and grazing. Fire suppression and changes in fire regime from changes in terrestrial vegetation may have impacted the amount of water in aquatic ecosystems and the nature of impact from recent and current fires. No detailed information is available.

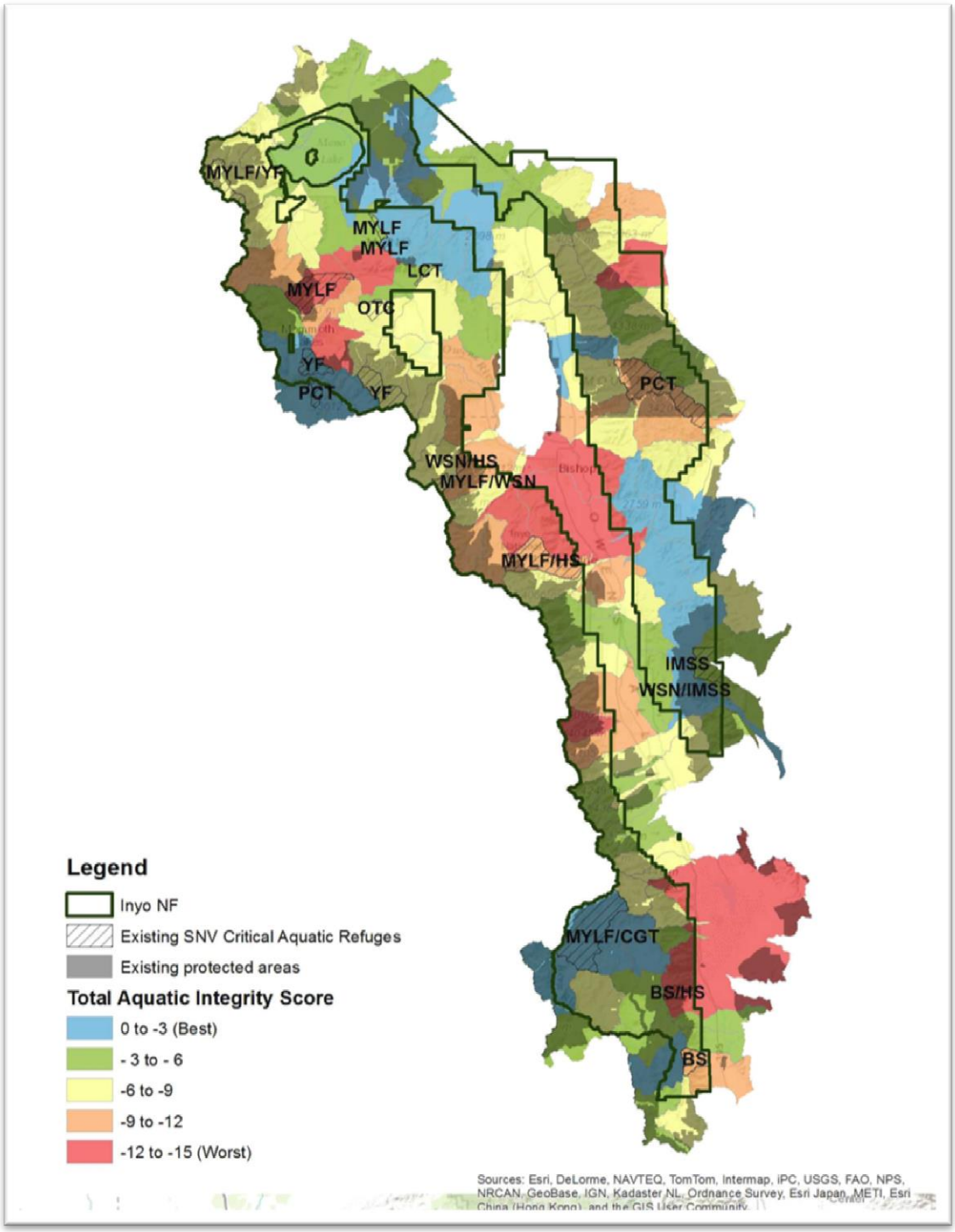
A multi-factor index of aquatic ecological integrity was developed in collaboration with Trout Unlimited and the Nature Conservancy. A set of readily available information on native species, habitat conditions, and stressors was compiled. A categorical score based on the best scientific understanding of aquatic species distribution, habitat, and stressors and their effects on aquatic habitat quality was developed. These were applied at the watershed (approximately 10,000 acre scale). This watershed data "summary and scoring" approach is a standard conservation planning tool and is a core approach within the Forest Service Watershed Condition Framework, and similar products developed by partners such as Trout Unlimited.

The factors considered in the composite aquatic habitat integrity analysis cover stressors related to road networks, habitat connectivity, land use, and water quantity. The scoring system and sources of information are described in more detail in the Bio-Regional Living Assessment, Chapter 1. Specific factors include: road density, roads in riparian zones, percent of historical connected stream network available, percent of urban or agricultural land use, percent of grazing leases, and the number of active and abandoned mines.

Aquatic habitat integrity within the Inyo NF is generally highest in the higher elevation portions of the analysis area and within existing protected areas on public lands. The primary factors contributing to the lowest aquatic integrity scores are road densities and riparian road networks, grazing, mining lands, and canals and diversions. Many critical aquatic refuge (CAR) areas are wholly encompassed within high aquatic integrity and protected areas, especially those for California golden trout and the Inyo Mountains

slender salamander. Only the CAR for Mountain yellow-legged frog near Mammoth Lakes occurs within a sub-watershed in the lowest aquatic integrity class.

The map below is one of a set of three developed for the collaborative aquatic ecological integrity assessment that included: rare species diversity, projected changes in water with climate, and index of stressors. This map is of the index of stressors. The legend includes the following: dark lines around the boundary of the Inyo NF; slanted black lines over existing Sierra Nevada critical aquatic refuge areas (USFS 2001); gray over existing protected areas (wilderness); and the following colors for ranges of total aquatic integrity scores, best- 0 to -3 worst, green -3 to -6 marginal, yellow -6 to -9 poor, orange -9 to -12 very poor, and red -12 to -15 worst. The colors are shown by large watersheds. There are several areas of blue, in the north, to the east and southwest or Mono Lake, in the center of the forest in the south half of the White Mountains, and on the Kern Plateau in the south. The worst areas depicted by red and orange, are mostly in watersheds outside of the forest in basins to the east of the Sierran Crest, east of the Kern Plateau, south of Owen's valley. There are also several small ones in the June Lake area. The rest is yellow or green. Overlaid are some letters that are acronyms for species occurring in critical aquatic refuges: OTC = Owens tui chub; IMSS = Inyo Mountains slender salamander; MYLF = Mountain yellow-legged frog; WSN = Wong's springsnail; LCT = Lahontan cutthroat trout; PCT = Paiute cutthroat trout; CGT = California golden trout.



Aquatic integrity scores

Riparian Ecosystems

Riparian ecosystems are a critically important component of biodiversity, supporting a higher concentration of species diversity than most terrestrial ecosystems. They serve in part as a link between aquatic and terrestrial ecosystems, and play numerous important roles within the broader landscape, such as providing for wildlife habitat including habitat corridors, nutrient cycling, and proper watershed function. They are also attractive for many uses, such as grazing, camping, fishing, and hydropower production. Despite their importance Kattelmann and Embury (1996) estimated that riparian vegetation currently makes up less than one percent of the Sierra Nevada bio-region.

Riparian ecosystems are formed by the interacting effects of flooding, soil wetness, water table level, proximity to streams, height above water level, sediment and ice scouring. Meadows are areas where grasses, sedges and rushes are dominant and flowering plants common. Willows, alders, cottonwoods and other woody vegetation dominate non-meadow riparian ecosystems, but flowering plants, sedges, and grasses are often present. Aspen is also often present in riparian ecosystems, but because of its importance in terrestrial ecosystems, it was discussed as a special type above.

Natural Range of Variability: Vegetation and Fire and Fluvial Processes

Riparian meadow and non-meadow plant communities are formed by the interacting effects of flood frequency and intensity, soil saturation and depth of water table, proximity to the channel, the height above water level, sediment deposition, and ice scouring. Riparian non-meadow areas include both woody species of shrubs and trees, as well as herbaceous grasses, grass-like species, mosses, and ferns (Fites-Kaufman et al. 2007). These non-meadow riparian settings generally have shallower soils, or occur more often on steeper slopes, have rocks in the soils, and lower water-holding capacity of soils than meadows. Riparian vegetation along streams varies considerably on the forest, ranging from clearly defined bands of riparian forest dominated by cottonwood, willow, and birch, to simply a strip of herbaceous riparian plants with upland forest trees growing next to the stream throughout much of the conifer forest belt.

The primary influence on non-meadow riparian ecosystems on the Inyo NF is the manipulation of water. Water management activities conducted by Southern California Edison and the Los Angeles Department of Water and Power have had the most influence on the condition of non-meadow riparian ecosystems on the forest. De-watering has had the most significant impact on streamside riparian systems in the recent past, such as Bishop Creek, Rush Creek, and Lee Vining Creek (Stine et al. 1983). Changes in regulation of these systems have re-established flows, and riparian vegetation is in the process of re-establishing on the streambanks and floodplains (McBain and Trush Inc., Read and Sada, 2010). Changes in riparian vegetation associated with changes in flow other than de-watering are more subtle, and are influenced by other factors, such as geomorphology and springs.

Fire suppression, and other management that limited fire in riparian zones, has had a direct effect on the composition and structure of riparian vegetation. Fires naturally spread into riparian areas, although sometimes in different ways and frequency than into adjacent uplands. The fire regime in non-meadow riparian ecosystems and the consequent effects of fire suppression in these systems are variable. Narrower, more incised streams reportedly mirror adjacent upland characteristics. For example, if the adjacent upland has been affected by years of fire suppression, the riparian area is likely similarly affected, with elevated fuel loads, higher stand densities, and other conditions characteristic of ecosystems that have missed several burn events (Hunsaker and Long 2013). Lack of fire creates less patchiness, less diversity of plants and structure,

and fewer associated animals. Increased conifer and overall vegetation density and uniformity in riparian areas result in higher-intensity fires across large areas, sometimes across entire watersheds or basins. On the Inyo NF, these effects have most likely occurred on the Kern Plateau landscape. Information on the ecological role of fire in riparian areas, Native American fire management, and current observations to very high intensity fire at times suggests they are resilient to low and moderate intensity fire, and that ecological integrity is enhanced by low to moderate intensity fire.

Over the next century, climate change is predicted to alter hydrologic regime, precipitation patterns and the role of fire in riparian areas. This will have important effects on riparian ecosystems, since they are shaped and are dependent on the amount and pattern of water. Natural floods inundate healthy floodplains allowing for the growth of native seedlings. Climate change has the potential to affect surface and groundwater flows. Climate change has already led to earlier snowmelt, earlier stream flow peaks, and lower summer base flows. It is predicted that the future climate will continue to cause progressively shorter winters and shorter duration of snowpack. Many models also predict that there will be more severe floods due to higher temperatures and more rapid snowmelt, whether precipitation increases or decreases (Miller et al. 2003). Some models also predicted that drought severity will increase (Coats et al. 2010). If there are more severe floods that follow severe droughts, erosion of stream channels could increase. Streambank vegetation could decrease in vigor and extent if summer base flows become much lower or some perennial streams become intermittent. Then, when high flows occur, there would be a greater chance of channel scour and possibly widening or gully incision.

Vegetation Structure and Integrity

Non-meadow riparian areas are present in at least small amounts in all assessment types on the Inyo NF, but have the greatest mapped acreage within sagebrush, subalpine forests, and alpine ecosystems. Willows, alders, cottonwoods and other woody vegetation dominate the upper layers of these ecosystems. Water birch and black oak dominate a small number of riparian sites. The California Natural Diversity Database (CNDDB) recognizes Water birch as an uncommon type. Black oak is found across extensive upland terrestrial areas on the western slopes of the Sierra Nevada, but on the Inyo NF it is restricted to areas with high soil moisture. Mojave riparian forest is found in one location on the forest, and is also recognized in the CNDDB.

Riparian vegetation is intimately tied to water quantity, flows, and stream channel condition. As described above, these fluvial processes have been impacted on the forest where water development has occurred, and past intensive management (grazing, roads, agriculture) have affected channel and stream condition. Road density in these ecosystems is currently 1.44 miles per square mile. This relatively high value reflects the tendency of travel routes to follow canyon bottoms where woody riparian vegetation is typically found. Watershed condition such as stream incision or channel stability will likely continue to affect riparian ecosystem structure and function on the Inyo NF over the next decades. Some heavily modified channels may be difficult to bring back to the natural range of variability.

Non-meadow riparian systems on the Inyo NF have been impacted by recreation use. These ecosystems have historically been and currently are attractive locations for campgrounds, fishing, recreation residences, and resorts, resulting in soil compaction and erosion, loss of vegetation productivity, introduction of competitive non-native species, and fragmentation of habitat.

Invasive species will continue to be a primary issue of concern affecting meadow and non-meadow riparian ecosystems in the future. Sawyer (2013) noted that riparian zones are among those areas of the Sierra Nevada most impacted by non-native invasive species, with altered riparian systems being especially vulnerable (Schwartz et al. 1996). Invasive plants that affect riparian structure and function the most include salt cedar, perennial pepperweed, sweet clover, bouncing bet and whitetop. Approximately 300 acres of non-meadow riparian are currently occupied by one or more non-native plant species. Warming temperatures will potentially influence the establishment and subsequent spread of non-native species in these areas.

Meadows and Fens

Meadows, seeps and springs in the drier habitat on the Inyo NF provide important habitat for plants and animals. Many plants and some animals are restricted to these sorts of habitats. Fens are a particular kind of wet meadow that receives abundant groundwater, and may support peat soils. A number of plant and insect species only occur in fens. Meadows and fens are dependent on snowpack to sustain the water throughout the long dry period of summer. As the rain-snow interface changes, lower elevation meadows and fens will be increasingly at risk. Meadows occupy between 30,000 and 50,000 acres on the Inyo NF, depending on the definition and the scale of mapping. When dry alpine or subalpine meadows are included, the area is increased. The landscape of meadows extent depends on location. On the Kern Plateau, meadows occupy an estimated ten percent of the landscape. In contrast, in the Ansel Adams and John Muir Wilderness areas, meadows encompass only about 1.5 percent of the landscape. Meadow condition depends on hydrology, stream channel condition, and invasive species (Purdy et al. 2012). The ecological integrity of meadows is based on vegetation, soils, hydrology, and animals. Information that is available for the ecological integrity of meadows on the Inyo NF focuses mostly on the vegetation and sometimes limited aspects of soils or hydrology.

There have been no systematic condition assessments of all the meadows on the Inyo NF. Researchers sampled ten randomly selected meadows on the Inyo NF, as part of a Sierra Nevada study (Fryjoff-Hung and Viers 2013). Otherwise, assessments have focused on meadows where range allotments are or pack stock use occurs. These may not represent overall conditions on the forest.

Fryjoff-Hung and Viers (2013) conducted a meadow assessment which looked at vegetation cover, bare ground, and conifer or upland shrub (e.g. sagebrush) encroachment. They found that vegetation cover and bare ground cover ranged from natural condition to moderately or heavily impacted, depending on location. Encroachment was the most common impact, with 60 percent moderately impacted and ten percent slightly impacted. Amendment 6 data were available for 69 meadow key areas. Results show that 35 percent were in excellent condition, 35 percent were rated as good, 23 percent as fair, and 7 percent as poor. Lower ratings indicated lack of surface litter, greater bare ground cover, soil compaction and/or rilling. Higher ratings were correlated to greater plant diversity and vegetation cover. See Chapter 8 – Range of this assessment. Grazing is an important driver and stressor in meadow ecosystems, and its effects are discussed in more detail in Chapter 8 – Range of this assessment. Data presented in Chapter 2 of this assessment show that stream and spring morphology have been affected by grazing on the forest, but that more recent grazing practices seem to be allowing for maintenance of current conditions or improvement in most areas. Most of the effects are trampling from hoof action, stream incision, widening, or headcutting. Vegetation usually recovers within years when grazing management is altered or when grazing is excluded from a streamside area.

Streams in “proper functioning condition” are defined as those that can withstand high flows without excessive erosion. See Chapter 2 of this assessment for more information. Functional-at-risk streams can

withstand high events, but have existing soil, water or vegetation attributes that makes them susceptible to degradation. Nonfunctional means that stream characteristics are not able to dissipate stream energy and not stable during high flows. Proper functioning condition (PFC) was assessed for 114 sites. Part of the PFC rating was based on the condition of streambank vegetation. Of the stream reaches assessed, 77 percent were rated as PFC or at risk with an upward trend, and four percent were rated non-functional.

Fens play an important role in nutrient cycling and groundwater discharge, provide habitat for rare species, and are a major sink for atmospheric carbon (Weixelman and Cooper 2009). Proper functioning condition information for fens indicated that most either were properly functioning, or had an upward trend, or no trend. A small proportion was found to have a downward trend.

There are a number of land uses and use features that can affect meadow and fen condition such as water diversions, improper livestock grazing, ditches and roads, and stream channel incision (Weixelman and Cooper 2009). Road density in meadow ecosystems is estimated to be 1.02 miles per square mile of meadow. This can cause reduced water table and channeling, disrupting soil water for native species. Stream channel incision, where the stream drops below the surface of the meadow, can be caused by numerous factors. See Chapter 2 of this assessment for a more detailed discussion.

Herbst et al. (2012) found that many stream morphology metrics were significantly different in grazed verses un-grazed areas on the Kern Plateau, including bank erosion, bank angle, and percent fines. However, unpublished Inyo NF data indicate that all stream reaches through meadows in grazed and rested allotments fell within expected values for width and width to depth ratios, except for Monache Meadow, which showed that widths were wider and depths shallower than they should be for a functioning hydrologic system. Also, grazing management in Mulkey Meadows was changed in 2008, with demonstrated upward trends in riparian vegetation, and measurable decreases in streambank trampling (INF files). Other studies have found that grazing is associated with increased bank erosion, decreased substrate size, and wider and shallow streams in the Sierra Nevada (Hagberg 1994, Kondolf 1993, Micheli and Kirchner 2002). In the past 20 years, much restoration work has been completed in meadows on the forest, especially the Kern Plateau. Observations by forest staff suggest that, even in allotments that remain open to grazing, restoration and changes in grazing management appear to have improved stream and meadow condition overall. There are still some areas with active head cuts, unstable gullies, or relict gullies that may take centuries to aggrade. It is possible that some may not return to their pre-gully morphology.

Approximately 175 acres of meadow riparian are occupied by one or more non-native plant species, with cover ranging from low to high, depending on location. The primary invasive plant species of concern that occur in meadow ecosystems on the forest include bull thistle, dandelion, mullein, and spotted knapweed. These species can impact native meadow ecosystems in many ways, including reducing biodiversity and productivity, and affecting soil stability.

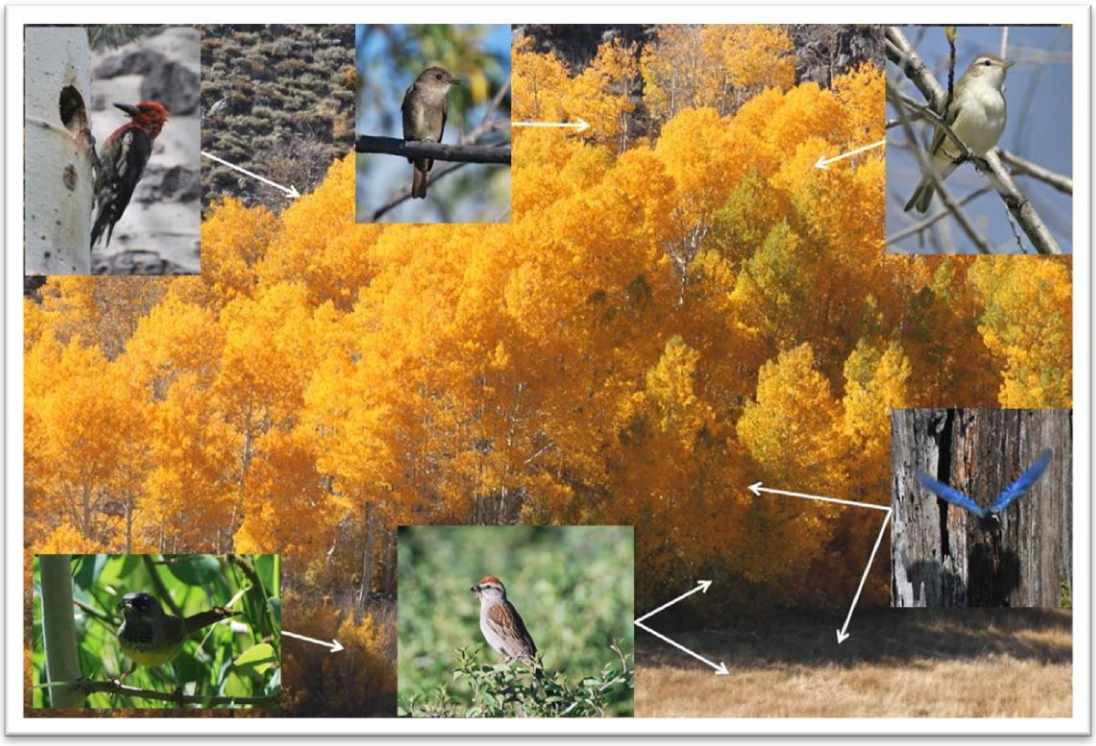
Animal Diversity

Riparian communities contain more plant and animal species than any other California community type, and about one-fifth of terrestrial vertebrate species in the Sierra Nevada depend on riparian habitat. About one quarter of wildlife species that depend on riparian habitat are considered at risk of extinction today. Connectivity of habitats is important for migratory birds, as well as amphibians and reptiles that use riparian areas. Species such as the willow flycatcher, and Mountain yellow legged frog, depend on different aspects

of riparian habitats and openings in meadows. For information on amphibians and fish of concern, see Chapter 5 of this assessment.

There is considerable diversity associated with aspen. Several bird species of management interest are associated with aspen including northern goshawk, red-breasted sapsucker, warbling vireo, and mountain bluebird.

The picture below shows an aspen grove. Many bird species, including warblers and woodpeckers, use aspen stands for nesting and foraging. The photo is dominated by a brilliant, bright gold, fall-foliaged aspen stand. In the background, along a gentle slope rising up is a sagebrush stand. In the foreground, a meadow that has dried up for the season is a dense patch of tan and brown sedges and grasses.



Aspen grove

Connectivity

Roads, road crossings, timber harvest, recreation use, livestock grazing, and dam and diversion dewatering can all block connectivity of aquatic and riparian habitat. There is no specific information on these conditions for the Inyo NF. These affect riparian vegetation by impacting vegetation directly, by altering channel conditions, and water patterns. General conditions are described below.

Recreational uses, such as hiking, fishing, or off highway vehicle use can affect stream morphology. In developed campgrounds or high use fishing areas on the Inyo NF, some streambanks are devoid of vegetation and paths accessing streams cause erosion and alteration of stream morphology. The loss of vegetation can reduce their stability during high flows. The extent of these impacts is unknown.

Road or trail crossings of streams, either at bridges or at low water crossings, alter stream morphology directly at the crossing, but there are very few cases across the forest where they have led to noticeable changes in stream morphology. The exceptions are at a few culvert crossings, where high velocities at the culvert outlet or other disruption in hydrology have led to downstream erosion. Wyman Canyon Road (Road 6S01) has major gullying at lower elevations, likely due to a blowout related to a road crossing. Other exceptions are the few off highway vehicle roads located in a stream channel, some of which are due to diversion of flow by an existing road causing the stream to move into the road bed. The extent of these impacts was analyzed in the 2009 Travel Management Project and in other site-specific projects.

Extensive riparian and aquatic monitoring has been completed by Southern California Edison and the forest since 1991 in riparian areas where dams and diversions are. Information on dams and diversions can be found in Chapter 2 of this assessment.

Ecological Integrity

Past land management, current management, disease, and other stressors limit the biodiversity of riparian ecosystems. However, climate change is a stressor which may limit plant species in the future as temperature, water availability, timing and quantity of water change. We do not know how riparian areas will function in the future as warming trends continue. When vegetation structure alone is considered, riparian areas in non-meadows are currently overall in good condition, and most are able to recover from most disturbance imposed by human influence or are within the natural range of variability. However, invasive species, fire, and climate change remain stressors on riparian condition.

Across the southwestern United States, seasonal and average annual temperatures are predicted to continue to rise throughout this century, and average annual and spring precipitation are projected to decline. This trend projects further decreases in mountain snowpack, earlier snowmelt and peak stream flows, and greater drought severity (Cayan et al. 2008, Harpold et al. 2012, Overpeck et al. 2012). Within the Sierra Nevada, models project a decrease in snowpack of 20-90 percent over the next century. Flood potential is predicted to increase, as is the proportion of precipitation falling as rain instead of snow (Overpeck et al. 2012, Safford et al. 2012a).

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

In 2004, the Forest Service produced the National Report on Sustainable Forests (USFS 2004). It included a summary of the current condition of forests, based on a variety of ecological, social and economic indicators of sustainability. Much of the information came from Forest Inventory and Analysis (FIA) plots, satellite-based vegetation maps, and national economic and social monitoring of national forests.

The following table summarizes the findings from this report, including current conditions and trends for sustainability characteristics.

Current conditions and trends for sustainability characteristics (National Report on Sustainable Forests 2004)

Characteristic	Condition Bio-Regional Assessment (2013)	Condition Forest Assessment (2013)	Trend
Ecosystem Diversity			
Extent of area by ecosystem type and successional stage or age-class	Low levels of old forest and possibly early seral. Low levels of within-patch diversity.	High levels of old forest, possibly, except Jeffrey pine (moderate) low levels of early seral. Low levels of within-patch diversity.	Trend to maintain except with warming climate, high possibility of increased high intensity fire that could decrease old forest and increased early seral habitat. Unknown effects on within-patch diversity- could increase with managed fire and restoration.
Extent of area in protected areas	High in southern half of bio-region at high elevations.	Low at low and mid-elevations, high at higher elevations (wilderness).	Designated wilderness increased in 2009 as result of Omnibus Bill
Fragmentation of Ecosystem Types	Low to moderate	Low for terrestrial, moderate for aquatic and riparian	Some increase due to timber, fire suppression, but improvements due to Travel Management
Species Diversity			
Number of forest-dependent species	See Chapter 5		
Status of species at risk (legal status*)			
Genetic Diversity			
Species with range contraction	Genetic diversity not assessed in bio-regional assessment	Genetic diversity not assessed in Inyo NF assessment.	Not assessed.
Invasive Species	See Chapter 1 and 3		

The diversity of unusual plant assemblages is very high, due to its proximity to the west side of the Sierra, High Sierra, Mojave Desert, and the Great Basin.

Historically and currently, riparian and aquatic ecosystems have been valued for their economic uses, including transportation corridors, water supply, electricity, construction materials, settlement, agriculture and livestock. Biologically, both aquatic and riparian areas provide special habitat for some endangered or threatened species, refuge and water for upland species, corridors for species movements, and thermal refuge for aquatic species.

Information Gaps

Terrestrial

There is limited baseline information for the indicators that pertain to resilience. However, Forest Service direction is explicit in its requirement to assess the sustainability or resilience of ecosystems (FSH

1909.12.10.13 Version 2/14/2013). Baseline information is limited because indicators of resilience need to be measured at a broad extent, at multiple spatial scales, and frequently enough to enable the detection of change, and provide the opportunity for management response. For example, the specific distribution and patterns of invasiveness of cheatgrass on the Inyo NF are not known, and rates of conifer encroachment are difficult to track.

Furthermore, there is a need for improved technological data collection and data sharing tools to access information for indicators. Most tools enable information sharing within single disciplines, and interdisciplinary information, especially regarding resilience, is generally unavailable. In the Sierra Nevada Science Synthesis, Long et al. (2013a) recognized the need for valuation and decision-making tools that can be used to link indicators, prioritize monitoring, and ensure that monitoring results are integrated into the development of management strategies. In particular, the ability to measure process-based indicators, such as disturbance and recovery, and summary of information at the appropriate scale, was identified as a critical gap in current information (Long et al. 2013b).

Aquatic and Riparian

Gaps include current population data for known species, as well as population locations and current condition of habitat in many of the land designations, such as the critical aquatic refuges (CARs), wilderness, and wild and scenic rivers. Data for the riparian ecosystems on the forest are limited. The information available focuses on range condition and invasive species data. It is important to note that the vegetation and streambank condition data were gathered for the purpose of monitoring range condition on grazing allotments. Forest Amendment 6 transects were located in range key areas, which are sample areas selected to be representative of ecological and vegetation characteristics on a unit or allotment. Long term monitoring plots were located in areas most likely to show change and transition, and are not necessarily reflective of the overall condition of an area. As such, these condition ratings are likely not representative of meadow systems on the forest as a whole.

As discussed below in the current conditions for geographic distribution, accurate data for the extent of riparian ecosystems on the forest were lacking, especially for small meadows and for linear features. Improved methods are strongly needed to adequately assess trend in these systems over the upcoming planning period, especially given projected change to these systems as the climate changes.

Chapter 2: Assessing Air, Water and Soil Resources

Important Information Evaluated in this Phase

This assessment focuses on the current condition of air, water and soil resources across the Inyo NF. All lands in the Inyo NF were included in this assessment. Information came from Chapters 2 and 8 of the Bio-Regional Assessment and the Inyo NF Chapters 2 and 8 topic papers. Stream flow information was obtained from the U.S. Geological Survey (USGS) and the Los Angeles Department of Water and Power. This chapter summarizes the Inyo NF Chapter 2 topic paper.

Air Resources

The Inyo NF is almost entirely within the Great Basin Unified Air Pollution Control District, with a small portion in the Reds Meadow and Ansel Adams Wilderness within the San Joaquin Valley Unified Air

Pollution Control District. The Ansel Adams, John Muir, and Hoover Wildernesses are Class I airsheds, meaning they have the highest standard of air quality. The portion of the forest in Nevada is under the State of Nevada's "15 Rural County" regulations. Counties are the smallest units by which the Nevada Division of Environmental Protection regulates air quality.

Based on prevailing wind direction, fires or other air pollution sources to the south, west and north of the forest have a greater potential to affect air quality on the forest, and those to the east have less potential to affect the forest's air quality.

This table displays air quality meeting state standards for the Inyo NF. The pollutants covered by this inventory are the criteria pollutants of total organic gases (TOG), reactive organic gases (ROG), carbon monoxide (CO_2), nitrogen oxides (NOx), sulfur oxides (SOx), particulate matter (PM), particulate matter less than ten micrometers (PM_{10}), and particulate matter less than 2.5 micrometers ($PM_{2.5}$). A stands for attainment, N stands for nonattainment, and U stands for unclassified.

Air quality meeting state standards for the Inyo NF

Jurisdiction			Pollutant								
Air Basin	**Air District**	**County**	**CO**	**Ozone (O3)**	**NO2**	**SO2**	**Hydrogen Sulfide**	**PM2..5**	**PM10**	**VRP**	**Lead**
Great Basin Valleys	Great Basin Unified	Inyo	A	N	A	A	A	A	N	U	A
Great Basin Valleys	Great Basin Unified	Mono	A	N	A	A	A	A	N	U	A
San Joaquin Valley	San Joaquin Valley Unified	Tulare	A	N	A	A	U	N	N	U	A
San Joaquin Valley	San Joaquin Valley Unified	Fresno	A	N	A	A	U	N	N	U	A
San Joaquin Valley	San Joaquin Valley Unified	Madera	U	N	A	A	U	N	N	U	A

Water Resources

The Inyo NF completed a watershed condition assessment in 2010, using the HUC12 watersheds, as defined by the United States Geological Survey. The purpose of the assessment was to determine the need for improvement. The assessment determined that about 74 percent of the watersheds on the forest are in "good/functioning" condition, while the remaining 26 percent are in "fair/at risk" condition.

Cumulative watershed effects studies (Inyo NF 2009) found that the most heavily impacted watershed, Mammoth Creek, had less than six percent of its area impervious. The threshold for effects to peak flow timing and yield ranges between 14 percent and 20 percent. Therefore, because no watershed had over six percent impervious surfaces, it is assumed that there are no flow alterations from development on the Inyo NF.

Water quality on the Inyo NF is generally good, due to low population and levels of development. However, Mono Lake, unlike other lakes on the forest, is an ancient terminal lake with no outlet resulting in naturally high levels of salinity and mineral content, and is alkaline, with a pH near 10. Reduced inflow from tributary drainages has increased salinity beyond natural levels.

Results from proper functioning condition evaluations of grazing allotments in the past five years show that stream and spring morphology have been affected by grazing on the forest, but recent grazing practices are improving conditions. In the Ansel Adams and John Muir Wildernesses, monitored from 2000-2004, a little more than half of all analyzed streams were in proper functioning condition, around 40 percent were functional-at-risk, and very few were found to be non-functional.

The Los Angeles Department of Water and Power uses water from the Mono and Owens River watersheds for municipal use. Their annual water quality reports show that water quality met all drinking water standards.

The State Water Resources Control Board listed four water bodies that are water quality limited: Mono Lake, Mammoth Creek, Hilton Creek and Rock Creek.

Fecal coliform has been noted in streams with cattle present. Timber harvest and prescribed fires have not been found to cause water quality degradation on the Inyo NF.

Results of recent monitoring by the Inyo NF and the Lahontan Regional Water Quality Control Board showed that during cattle presence, fecal coliform levels met the Lahontan Regional Water Quality Control Board basin plan objective of 20 cfu/100 ml in 14 percent of samples. Fecal coliform levels were below the USEPA 200 cfu/100 ml standard in 45 percent of samples and were over the 200 cfu/100 ml level in 55 percent of samples. In grazed areas where cattle were not present at the time of sampling, fecal coliform was always below 200 cu/100 ml. In areas that were never grazed (background levels), all samples met the Lahontan standard of less than 20 cfu/100 ml. Study designs or reporting were not sufficient to determine timing or spatial extent of effects. Samples were not taken downstream to determine if adverse effects persisted. Results are summarized in Goehring 2012, Goehring 2013 and Lahontan Regional Water Quality Control Board 2012.Although no statistical analysis has been completed, it appears that in areas with low flow, fecal coliform levels are high, and when flow is higher, levels are lower. This pattern does not apply with recent rain, which tends to increase fecal coliform levels. The few samples taken the day after a rainstorm had high levels of coliform (over 1,600 cfu/100 ml), even though flowers were high on that day. Again, study designs were not sufficient to determine timing or spatial extent of effects.

Soil Resources

Soils on the Inyo NF vary greatly across the landscape, even at a local scale. However, there are general soil characteristics for large regions of the forest that correspond with the ecologic unit inventory sub-regions. Soils vary by elevation and latitude as a result of temperature and precipitation differences, and also vary based on the type and age of parent material.

Fen soils are unique because they have peat soils that contain high amounts of organic matter. Fens are relatively rare in the Sierra Nevada, and take thousands of years to develop. They can support rare species and are a major sink for atmospheric carbon (Weixelman and Cooper 2009).

Meadow soils are not as organic-rich or wet as fen soils, but still have more organic matter and are wetter than most soils on the forest. The organic material and fine grained sediments, plus the degree of wetness, make the meadow soils subject to compaction.

Meadows cover about 18,200 acres of the forest. While meadows make up about 0.8 percent of the forest, they are most common in the Kern Plateau region. There, they make up about ten percent of the land area.

Shallow soils are defined as soils less than 20 inches deep (Soil Survey Division Staff 1993). They are sensitive because they are susceptible to erosion. They are generally weakly developed, with relatively little organic matter, and therefore have low nutrient levels. Any soil displacement or loss can affect their productivity. When soil is shallow, runoff can infiltrate to the bedrock layer and run along that layer, carrying the overlying shallow soil with it. Shallow soils are found throughout the forest, on a majority of sites. They are most common in steeper areas, high elevation areas, and areas of recent geologic deposition, such as volcanic deposits. Forest coverage shows that shallow soils are most common, predictably, in rocky areas of the forest, and almost the entire White and Inyo Mountains.

High erosion hazard soils are defined by a combination of soil texture, slope, permeability, vegetative cover, and climate. Generally, soils on the Inyo NF have a higher erosion hazard rating when they are on steeper ground, have finer texture, less vegetative cover, and more intense rainfall (USDA Forest Service 1995).

Nature, Extent and Role of Existing Conditions and Future Trends

Air Resources

Other than smoke from fires and dust, the forest has little to no control over air quality conditions. Most forest management activities, excluding fire, have little to no effect on air quality, and any emissions from forest management activities are too small to measure.

Meteorology, topography, and vegetation influence smoke characteristics of both wildland and prescribed fire. Wind patterns determine where and how long smoke from a fire will persist. Topography can influence smoke concentrations as mountain ridges can trap smoke in valleys. Vegetation characteristics such as moisture levels, density, and structure can influence the amount of smoke produced by a fire.

Prescribed fire produces smoke emissions, but those emissions are less compared to wildfires. PM_{10} emissions from wildfires on the Inyo NF averaged 625 tons per year. Prescribed burn PM_{10} emissions on the Inyo NF (US Forest Service 2001) for 1996 through 1998 ranged from 52 to 217 tons per year, with an average for the three years of 132 tons per year. Additionally, the table below displays data collected by the Great Basin Unified Air Pollution Control District, showing estimated annual smoke PM_{10} emissions from Inyo NF prescribed fires for 2001 through 2012 averaged 91 tons. Estimated PM_{10} emissions in 2003 include emissions from the Dexter Fire, a wildfire which was managed for Resource Objectives. See Chapter 8 of this assessment for additional information regarding wildland fire management on the Inyo NF. Further, prescribed burning contributes less than one percent of the total PM_{10} emitted from lands in Inyo and Mono Counties.

Estimated annual smoke PM_{10} emissions from Inyo

Year	PM-10 (Tons)
2001	80
2002	41
2003	226
2004	114
2005	54
2006	46
2007	50
2008	65
2009	140
2010	63
2011	137
2012	71
Average	91

The Inyo NF has applied prescribed fire on approximately 18,000 acres since 2002. Prescribed fire has had short term impacts to the Great Basin Unified Air Pollution Control District (GBUAPCD). However, personal correspondence with GBUAPCD stated “no recorded violations of California or federal ambient air quality standards from prescribed burns within the district.”

The Inyo NF is adjacent to the "largest single source of PM_{10} in the United States", which is Owens Lake (GBUAPCD). Dust emissions from the Owens Lake have contributed to non-attainment of the federal PM_{10} standard on lands adjacent to the Inyo NF. Mono Lake Basin also violates the federal PM_{10} standard, though to a lesser degree. Dust emissions are attributed to dry lake beds. The intensity and spatial distribution of dust impacts from the lakes on the Inyo NF's air quality cannot be quantified at this time. The City of Los Angeles is required to implement dust controls on the Owens Lake bed to reduce emissions, and to have reduced diversions from Mono Lake tributaries until lake levels increase, which will reduce windblown dust and other environmental effects.

Research plots for ozone injury were established in the late 1970s to late 1980s and found ozone injury throughout the Sierra Nevada (Bytnerowicz et al. 2003). Much of the Inyo NF is modeled as high exposure to ozone. For nitrogen deposition, most of the forest has been modeled as not exceeding the criteria.

Two air quality monitoring sites in the John Muir and Ansel Adams Wildernesses indicate that air pollution has been decreasing in the Inyo NF. In addition, the forest generally has little trouble meeting applicable air quality regulations. Most forest management activities, excluding fire, have little to no effect on air quality, and any emissions from forest management activities are too small to measure. Air quality regulations often drive when and where prescribed burning or pile burning can occur, which can slow implementation of the forest's fuels reduction management activities. Because the forest is required to meet air quality regulations during burning, the local air district has never recorded any air quality violations due to the forest's prescribed burning activities. This attainment is expected to continue.

Water Resources

Water from the forest supports several beneficial uses. This table describes those uses.

Beneficial uses from water from the Inyo NF

River Basin	Municipal or domestic	Agriculture	Power	Water contact recreation	Non-contact recreation	Warm freshwater habitat	Cold freshwater habitat	Inland Saline Habitat	Spawning	Wildlife	Groundwater Replenishment	Freshwater Replenishment	Sport fishing	Rare, Threatened or Endangered Species
Mono Basin	X	X	X	X	X		X	X	X	X	X	X	X	
Owens River	X	X	X	X	X	X	X		X	X	X	X	X	X
Upper San Joaquin	X			X	X		X			X			X	
Upper Kern River	X			X	X		X		X	X			X	X
Watersheds east of White and Inyo Mountains	X	X		X	X		X			X			X	X
Indian Wells-Searles Valley	X	X		X	X		X			X	X		X	

All six major watersheds support municipal use, recreation, cold water habitat, sport fishing beneficial uses. Water from the forest also supports power generation, and endangered species. Mammoth Mountain Ski Resort pumps ground water for domestic and snow-making uses and represents the largest single user of groundwater within the forest. Four wild and scenic rivers (WSRs) are currently designated on the Inyo NF. WSRs are designated for and protect water quality, free flow, and outstandingly remarkable values. Additionally, they protect water quantity to the extent that enough quantity must be present to ensure no degradation to the outstandingly remarkable values. WSRs are further discussed in Chapter 15 of this assessment.

Water users within the Inyo NF have not informed the forest of water shortages or effects to the water quality or quantity from forest activities. Water quantity for users is almost always sufficient, according to the limited information that is available.

Diversions for municipal and domestic use, as well as operation of dams for hydroelectricity modify flows on the forest. All but one eighth field watershed on the east side of the White Mountains supply municipal water. Within the forest, there are a total of 342 recorded water rights in California and 34 in Nevada.

About seven percent, or 117 miles of the 1,640 miles of perennial streams on the forest, as defined by the United States Geological Survey, are downstream of a dam. Therefore, about 93 percent of the perennial streams on the forest are free flowing and stream flows are functioning within their range of natural variability. However, the amount and locations of small diversion dams are unknown.

Currently, an average of 39 percent of the runoff produced into the Owens Lake and Mono Lake watersheds are exported to the City of Los Angeles for municipal uses (LADWP 2011). The 1988 LRMP reported that almost 50 miles of stream on the forest were de-watered from diversions and dam operations. However, every major stream that was de-watered in 1988 has been re-watered through the Federal Energy Regulatory Commission (FERC) dam relicensing process. Flows in these streams remain highly regulated. Streams from the forest that drain into the Kern or San Joaquin Rivers provide water to cities on the west side of the Sierra Nevada Mountains. Within the forest boundaries, the Kern and San Joaquin Rivers are free flowing with very few minor diversions.

The two major drivers for trends in water use will likely be population change and climate change. A predicted increase in population of California may increase the demand for water in the forest watersheds. An expected decline in precipitation, particularly as snow, as well as increased variability in flows that are predicted as a result of climate change, could decrease the supply of water. LADWP predicts that climate change will reduce their average annual aqueduct delivery from 254,000 acre feet per year to 244,000 acre feet per year between 2010 and 2035 (LADWP 2010). They also predict that demand will increase by an average of about 18 percent during that same period.

In the next 20 years, there may be increased demand for groundwater withdrawals on and adjacent to the forest with increased demand for municipal water supply and increasing variability in surface water availability. Further, there may be legal battles regarding surface water diversions on and downstream of the Inyo NF. Groundwater may be a more practical alternative to future supply needs.

Soil Resources

There are relatively few areas on the Inyo NF with widespread accelerated erosion beyond the natural range of variability. Erosion rates far outside of the natural range of variability have been observed mainly along

roads, developed areas such as ski areas, in streams in areas of concentrated grazing, and after wildfires of moderate or high intensity. Recent project design features and restoration activities, particularly on roads, developed sites, and streams with concentrated grazing, have improved soil erosion and transport issues in many areas.

A rapid assessment of the percent of each forest watershed compacted, which was completed as part of the 2009 Travel Management Environmental Impact Statement found that no watershed had greater than six percent compaction. The threshold of concern for watersheds on the forest is between 14 and 20 percent. Therefore, no watersheds are considered to be near their threshold of concern for cumulative watershed effects from compacted soil.

Compaction reviews in 150 meadow and upland sites within active cattle and sheep allotments were also completed. In meadows, approximately half the sites showed compaction. In upland sites, 56 percent had no observed compaction, 32 percent had minor compaction (at risk), and 12 percent had moderate compaction which could lead to a degraded rating. None of the sites were rated as non-functional for compaction.

The forest also assessed changes in the surface organic layer of soils in grazing allotments. In meadows, results showed that in 56 percent of the 75 sites evaluated, there was no observed alteration to surface organic layer thickness, 28 percent of the sites showed minor alteration, and the remaining 16 percent had moderate alteration. In upland, dry sites, 36 percent of the sites showed no alteration, 52 percent of the sites showed minor alteration of the surface layer, and 12 percent showed moderate alteration.

On the Inyo NF, fires are often observed to cause increased erosion, both from water and wind, and to a lesser extent, from dry ravel. Wildfires and soil erosion are natural processes that are part of the natural range of variability of the forest. Two recent debris flows on the forest occurred in watersheds that had recently burned. Prescribed fire has not been shown to increase erosion in most studies, due to low fire severity that often leaves soil structure and organic matter intact (Moghaddas 2013).

Erosion associated with timber harvest is usually limited to skid trails or roads, even on steeper slopes (Poff 1996). This has been found to also be the case on the Inyo NF. However, in most cases, the forest does follow slope restrictions and drainage structures are installed, preventing erosion on these skid trails.

Unpaved road erosion is common across the forest. Monitoring native surface road conditions found that about 65 percent are in good condition, 21 percent are in moderate condition, and ten percent are in poor condition. Chapter 11 of this assessment includes more information about road condition. Roads have not been identified as a mechanism for landslides on the Inyo NF.

Ski runs and roads at ski areas are another source of soil erosion. While rilling and gullying are extensive in the ski area, erosion is generally limited to within the ski area boundary. Both Mammoth and June Mountain Ski Areas have extensive ski run drainage systems and re-vegetation programs to reduce erosion.

The Inyo NF contains grazing allotments for cattle and sheep, and supports grazing by pack stock in wilderness areas, as well as in pastures outside of wilderness. For uplands, or dry sites, measures of erosion are: soil movement, surface litter and rock cover, pedestaling, flow patterns, rills/gullies/head cuts, and bare ground due to disturbance. The table below shows the results from monitoring at 73 different upland sites within grazing allotments.

Monitoring results from upland sites

Measure	Non-functional	Degraded	At-risk	Functional
Soil movement	0%	5%	41%	53%
Surface litter and/or rocks	0%	4%	47%	49%
Pedestaling	0%	5%	27%	67%
Flow patterns	0%	3%	3%	95%
Rills, gullies and head cuts	0%	1%	1%	97%
Bare ground due to disturbance	3%	11%	38%	48%

Similar monitoring was completed in wet sites, including moist and wet meadows, with slightly different erosion-related characteristics. The results of that monitoring showing the percent of meadow sites in condition categories are shown in the table below.

Percent of meadow sites in condition categories

Measure	Non-functional	Degraded	At-risk	Functional
Rills/gullies	0%	1%	32%	67%
Bare Ground	1%	7%	35%	57%
Head cuts and nick points	7%	16%	27%	49%

It is unknown how climate change will affect soil erosion. Because severe wildfire leads to high erosion rates, from hill slopes and stream channels, it is assumed that if climate change leads to more severe and large wildfires, the Inyo NF as a whole will have greater erosion rates. Streambank erosion may also increase. If streams tend to dry out earlier in the summer, or formerly perennial streams become intermittent, it is likely that there will be less riparian vegetation over time. This could lead to increased streambank erosion. Potential climate change effects to nutrient cycling and organic matter in soils has not been well studied outside of agricultural systems.

The Inyo NF and its partners are also actively implementing restoration actions to reduce erosion on roads, trails, dispersed camping areas, grazed areas, and other developed and dispersed recreation sites. These efforts are expected to continue, further reducing erosion on the forest.

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

There are four Federal Energy Regulatory Commission (FERC) licensed hydropower projects on the Inyo NF, for a combined total of about 55 megawatts (MW) of authorized capacity. All are owned by Southern California Edison (SCE). For comparison, there is a total of about ten million MW of hydropower capacity for all of California, 92 percent of which is on National Forest System (NFS) land. For context, one MW is enough energy to power about 750 to 1,000 California homes at one time. Therefore, although locally important, these are relatively small hydropower projects.

Water is necessary for human existence. Water originating on the Inyo NF supplies municipal water for communities across central and southern California, as well as agricultural water to California's Central Valley, though most diversions are well downstream of Inyo NF land. It also provides electricity for local and distant populations. Stream flows provide recreational opportunities for locals and visitors. Water is integral for ecological sustainability. On the forest, which is mainly arid or semi-arid, streams, lakes, springs, and their associated riparian areas are relatively rare and important habitats.

Soil has been modified in some areas and in others is largely intact. Overall current soil conditions are good with little compactions. Current erosion is site specific. Soils continue to support rare fen and wetland habitat. There are no reports or findings of productivity losses outside isolated disturbances such as roads. Soils are at risk due to high fuel loads that support high intensity fires, resulting in a very high potential for soil erosion.

Information Gaps

There is very little information about the amount of groundwater pumping within the forest and possible effects to groundwater dependent ecosystems or groundwater levels. There is very little information about the location of small diversions, the amount of water removed from streams with small diversions, and possible ecosystem effects.

Chapter 3: Assessing System Drivers and Stressors

Drivers and stressors are recurring events, processes or actions that affect ecosystems. These effects are important to ecosystem condition. For example, fire creates variation in habitat which is important for biodiversity; it is a "driver" of ecosystem condition. Fire can be a stressor when it is of high severity and outside the natural range of variation, either occurring less frequently or more frequently than in the past. The context in which fire occurs is also important. For example, because the scenery around the Mammoth Lakes area is important to this recreation center, high severity fire can decrease the scenic and thus recreation value.

Other important drivers and stressors are insects and pathogens, climate change, grazing, and more localized wind, landslides or other physical factors. Invasive plants are one of the most important, wide-spread stressors on the Inyo NF. Effects of these drivers and stressors are also addressed in the appropriate chapters of this assessment. For example, the effects of invasive species, climate change and fire on terrestrial biodiversity are covered in Chapters 1 and 5 of this assessment.

There are two main questions we ask to evaluate the sustainability of ecosystems: are drivers and the effects of stressors operating within the natural range of variability, and are ecosystems "resilient" to drivers and stressors. Resilience is a measure of the extent to which an ecosystem can be exposed to stressors yet still recover to the pre-stressor condition. Climate, fire, insects and pathogens, invasive species, vegetation succession, and vegetation management all occur simultaneously on the landscapes of the Inyo NF. All of these factors interact. When considering ecological sustainability as influenced by drivers and stressors, it is important to consider them all together.

Important Information Evaluated in this Phase

All lands of the Inyo NF were included in this assessment. In some sections, broader patterns for the larger bio-region were also discussed. For more detailed information on drivers and stressors see the Inyo NF topic

papers, and the July 18, 2013 snapshot of the Bio-Regional Living Assessment Chapter 3. Additional information was also obtained from peer reviewed scientific literature, the Sierra Nevada Science Synthesis, and the Bio-Regional Assessment Natural Range of Variability reports.

Nature, Extent and Role of Existing Conditions and Future Trends

Primary drivers and stressors selected were: climate change, air and water quality, fire, insects/pathogens, invasive species, grazing, timber, and vegetation management. Influences of water development, wildfire, and grazing are covered in detail in Chapters 1, 2 and 8 of this assessment. Impacts to people are covered in Chapters 6 through 14 of this assessment.

Climate Change

Climate change is a key stressor affecting long term ecological conditions. Effects of climate change are already apparent in rising minimum temperatures, earlier snowpack melting, changing stream hydrology, and increased frequency of large, severe wildfires (Safford et al. 2012b). These trends are expected to continue and possibly increase in magnitude or pace.

Most recent climate models project temperature increases of about five to nine degrees Fahrenheit in California by the end of the 21st century, with precipitation remaining similar or slightly reduced compared to today. Most models also agreed that summers will be drier than they are currently, regardless of levels of annual precipitation. Within the Sierra Nevada, models project a decrease in snowpack of 20-90 percent over the next century, although the southern Sierra Nevada is projected to maintain more snowpack than any other part of the range due to its high elevation. Flood potential is predicted to increase, as is the proportion of precipitation falling as rain instead of snow (Overpeck et al. 2012, Safford et al. 2012b). Many data sources point toward increasing frequency of debris flows, and weather events associated with increasing temperatures and changing amounts and seasonality of precipitation. See the Inyo NF Chapter 1 topic paper. Intensification of heat wave activity, including extreme daytime and nighttime temperatures are expected to become more common, and have been shown to be trends, rather than temporary aberrations, although desert areas may be less affected than coastal areas of California (Gershunov et al. 2009, Gershunov and Guirguis 2012).

Air and Water Quality

Current indicators of air quality include particulate matter, ozone, and ecosystem critical loads, described in Chapter 2 of this assessment. Air quality in the assessment area is affected by prescribed and wildland fire, dust from agricultural areas or lakebeds, mining, and pollution from other sources, both local and regional. Smoke from fires impacts air quality in the assessment area, and can affect recreation, scenic integrity, and human health, at least in the short-term. Smoke production from prescribed fires has been managed by conducting burns during favorable times of year (Bytnerowicz et al. 2013). Prescribed burning on the Inyo NF has been in compliance with state and federal air quality standards, although exceedences have occurred in the Owens Valley as a result of naturally ignited fires on the west slope of the Sierra Nevada.

Pollutants that cause ecological harm include ozone and nitrogen. The former has direct negative effects to plant productivity, and, especially when interacting with other stressors, can result in plant mortality (Bytnerowicz et al. 2013). Nitrogen deposition has probably had greater effects in the assessment area over the last few decades, though the impacts are not as severe as those seen on the west side of the Sierra

Nevada. Nitrogen deposition has an initial fertilizing effect on vegetation, but it alters nutrient cycles and can impair the ability of many species to resist disease. In aquatic ecosystems, excess nitrogen can cause algal blooms, severely affecting water quality, wildlife, and recreation (Derlet et al. 2009).

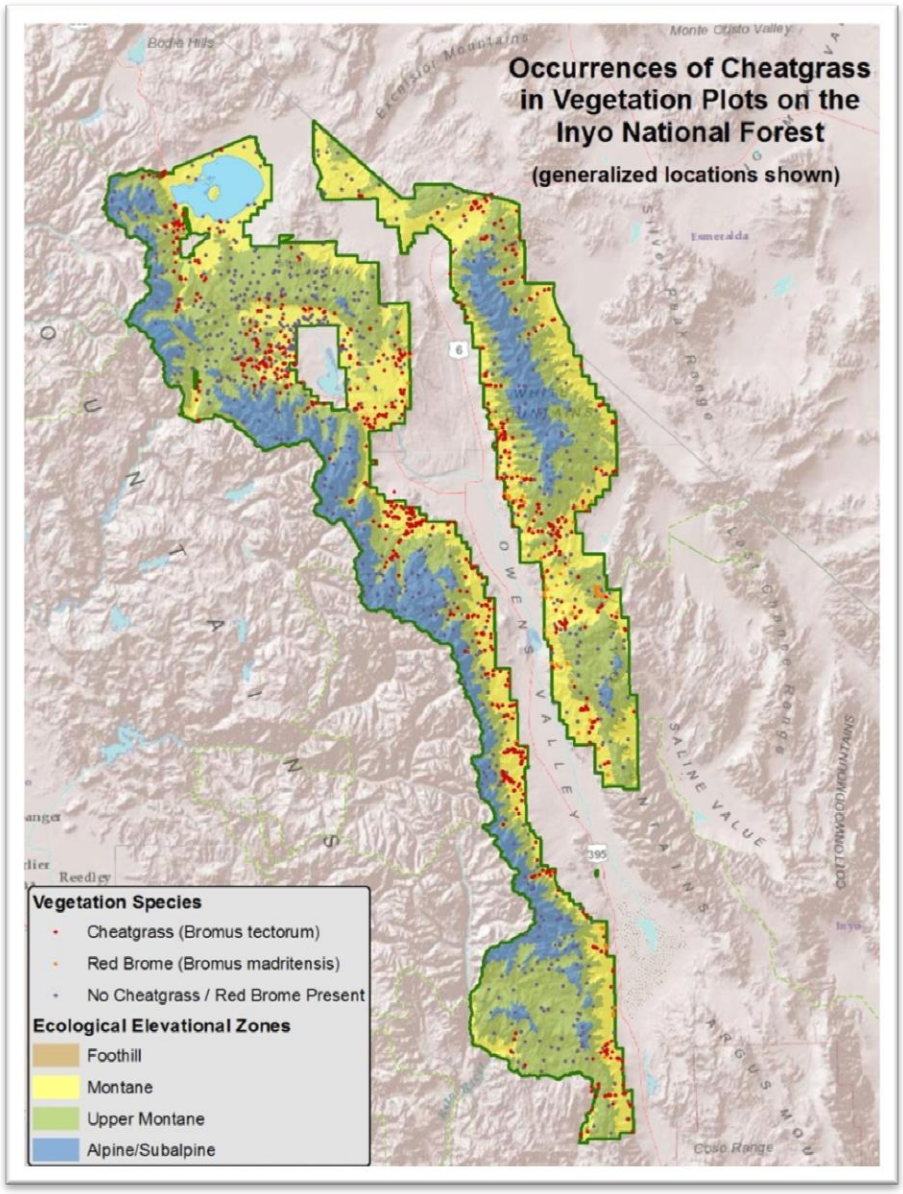
Fecal coliform and other toxics, such as arsenic, were used as indicators in the water section of Chapter 2 of this assessment. Water quality was generally found to be good on the forest, with some locations identified with limited quality. Diversions, surface mining, grazing, recreation, fire, and natural and unknown sources were all listed as causes.

Invasive Species

The influx of non-native species of animals and plants since the first Europeans arrived in California has changed the ecosystems of the Sierra Nevada, Great Basin, and Mojave Desert. This continues to be a major and increasingly important stressor on the Inyo NF. Invasive species includes all life forms including plants, animals, invertebrates, and fungi.

Invasive plant species are one of the primary stressors on the Inyo NF. They can alter fire regimes, influence water quality, reduce forage production, alter soil quality, lessen carbon sequestration, and decrease scenic character and wildlife habitat. A little over 45,000 acres of the forest are known to be occupied by 52 invasive plant species. Cheatgrass and red brome are the most common and invade sagebrush, Pinyon-juniper, and xeric shrublands at lower elevations. Cheatgrass has altered the fire regime some areas over the last couple decades. This annual grass grows rapidly, and, on senescence in the late spring to early summer, creates a continuous cover of dry fuels that ignite easily, resulting in large, rapidly spreading fires. Cheatgrass is also less desirable forage for wildlife and livestock, as compared to native bunchgrasses. In riparian plant communities, numerous invasive plants have taken advantage of the wetter conditions including salt cedar, bouncing bet, and lenspod whitetop. There are fewer invasive species at high elevations (D'Antonio et al. 2004, Klinger et al. 2006, Schwartz et al. 1996, Underwood et al. 2004).

The map below depicts the pattern of invasion of cheatgrass and red brome on the Inyo NF. Information from the Forest Inventory and Analysis (FIA) plots, Terrestrial Ecological Unit Inventory (TEUI) plots, and information from the invasive species application, National Resource Inventory System (NRIS) were combined. This does not represent a complete distribution of these invasive grasses but estimates the extent of their invasion. The map shows the Inyo NF across a tan shaded relief map of the surrounding area. The forest is colored by major elevational zones including: yellow for the lowest elevations, montane; next green for upper montane elevations; and at the highest elevations, blue for subalpine and alpine areas. Where these invasive grasses have been detected at survey plots, they are shown as red and orange dots. The Inyo NF appears as two long strips. On the left, the strip is along the crest of the Sierra Nevada Mountains down to the floor of Owens and Mono valleys. The one on the right is rising up from the east side of these valleys to the Inyo and White Mountain Ranges. The red and orange dots are dispersed throughout the lower elevations, mainly in the yellow, lowest elevation zones across the entire forest. They are particularly concentrated in the center portions of the Owens Valley and Mammoth Lakes Basin. There are only a few scattered areas where the red dots occur in the upper montane zone and subalpine zone.



Cheatgrass on the Inyo NF

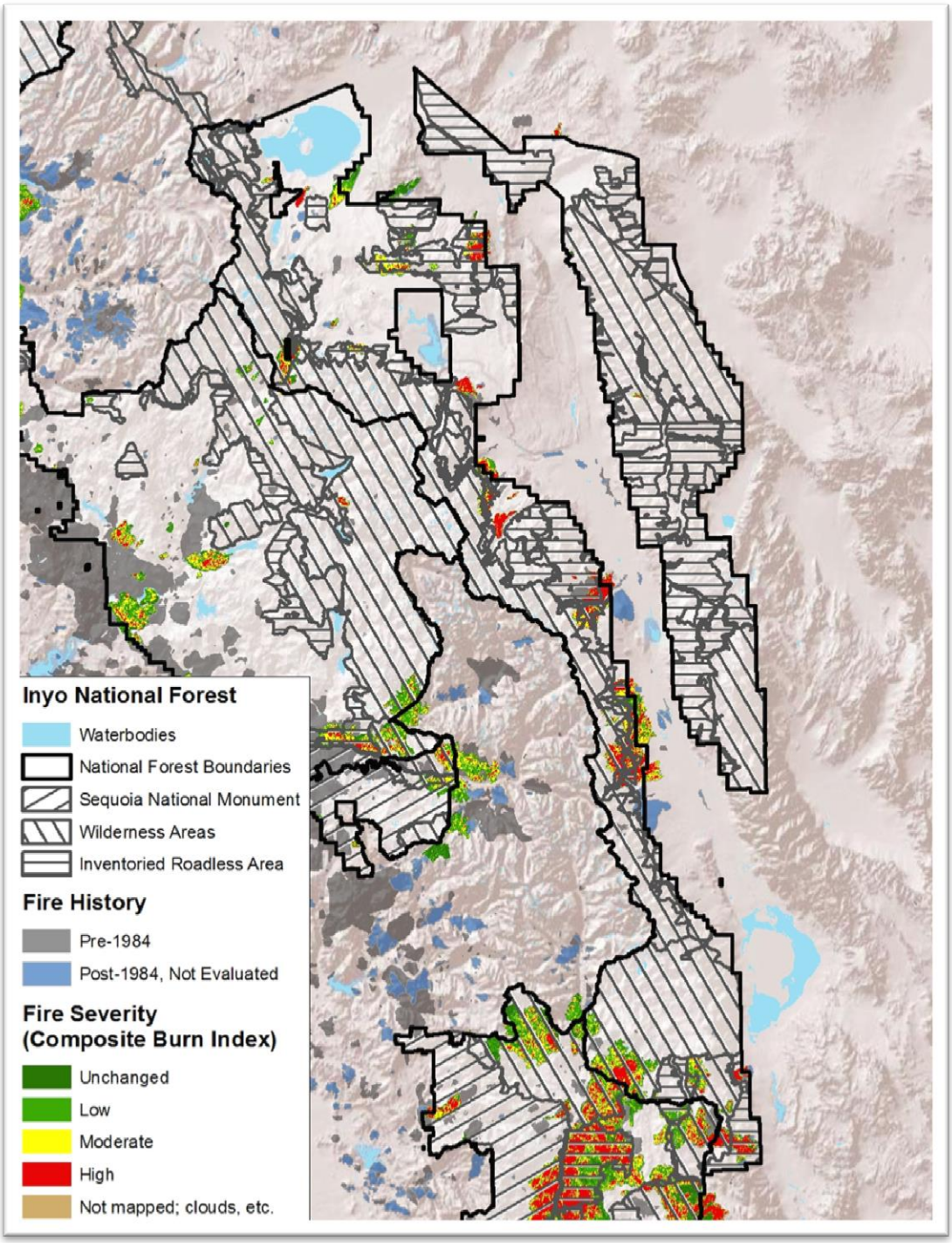
In the 1800s, the introduction of cheatgrass and red brome were thought to come from European settlement, grass feed and animal hoofs. Expansion of cheatgrass is thought to have occurred with heavy grazing which decreased native perennial grass cover, followed by drought in the early 1900s (Knick et al. 2011). Seeds are transported by people, vehicles, and livestock (Bradley and Mustard 2006, Mortensen et al. 2009). Cheatgrass become established where there is disturbed ground, such as along roads, where vegetation is cleared, or where the biological soil crust has been reduced (Baker and Shinneman 2004).

Invasive species are expected to increase over the next century (Finch 2012). Cheatgrass is expected to continue to move north and up in elevation across the western United States, and bring significant changes to areas where it is currently absent or sparse. This expansion will likely be in part due to a feedback between increased fire from cheatgrass (Balch et al. 2013) and increased cheatgrass following fire where native grasses are decreased (Chambers et al. 2007)

Fire

Fire has a major influence on many of the ecosystems and communities in the bio-region and on the Inyo NF. Fire has always been a fundamental ecosystem process in most ecosystems, shaping the landscape in the bio-region. On the Inyo NF, this role varies markedly across the forest. The map below displays fire history for the Inyo NF and for fires since 1984. Patterns of fire severity are also displayed. Fire severity has been mapped for fires since 1984, using satellite imagery (Miller and Thode 2007). These severity classes are from the Composite Burn Severity Index, which is measured one year post-fire and reflects a combination of mostly fire effects to vegetation plus some soil effects (Miller et al. 2009). The levels are shown by the following color scheme: low is green, moderate is yellow and high is red (greater than 95 percent change in canopy cover, i.e. stand-replacing fire). On top of the fires, widely spaced gray lines show different land designations: left slant for designated wilderness areas, and horizontal lines for inventoried roadless areas.

Most recorded fires are less than 100 acres, and these are not shown here. These smaller fires can play an important ecological role in many of the ecosystems on the Inyo NF and have been discussed more in Chapter 1 of this assessment. Thirteen fires greater than 500 acres have burned on the forest since 1995. Eight of these were ignited by lightning. There are several patterns of fire evident from the map. On the western portion of the forest, along the eastern flank of the Sierra Nevada, fires are concentrated in three locations. Most of them are along steep slopes. These fires tend to have moderate and high severity and burn in shrubland ecosystems, spreading rapidly on the steep slopes and with the high winds that are typical there. Other fires occur in the northern half of the forest, concentrated on the flatter areas to the south of Mono Lake. Most of these are in sagebrush and are wind driven. In the southern portion of the forest, on the Kern Plateau, there have been several fires with a mosaic of different severities. These are all extensions of managed fires that originated and burned in wilderness on the Sequoia NF.



Fire history on the Inyo NF

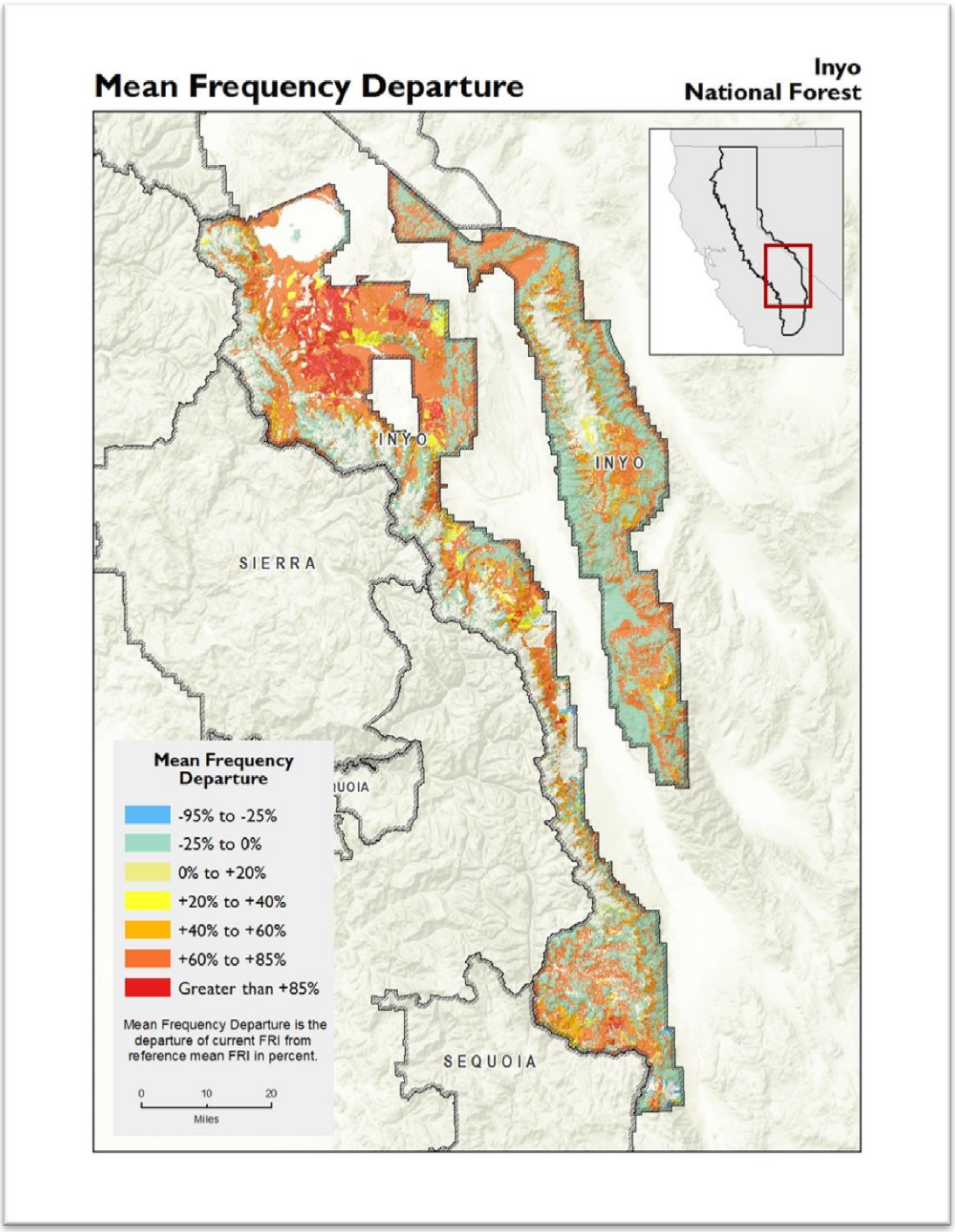
Understanding past fire regimes is important to understanding its current role on the landscape. For example, in the past, fire was rare in xeric shrublands and now it occurs more from human ignitions. In the past it was more extensive, widespread, and less intense in Jeffrey pine and pinyon-pine/juniper forests and woodlands. Over 100 years of fire suppression, human ignitions, and invasive plant expansion have led to

changes in the role of fire and detrimental effects to ecosystem integrity. In forested ecosystems, the lack of fire has increased fuel loads, tree and shrub density, and caused detrimental effects to communities and resources from too much shade and conifer litter in the absence of fire, and too much mortality and major ecosystem changes when fire occurs because it is of higher intensity than the ecosystem is adapted to. In sagebrush and xeric shrubland ecosystems, the spread of cheatgrass and red brome have led to more frequent fire and displacement of native species. Fire suppression, European-settlement activities, invasive plants, the wildland urban interface (WUI), and climate change have vastly changed the patterns of fire, and the ecological, social, and economic consequences of fire (Collins and Skinner 2013).

Safford and Van de Water (2013) compared current fire frequencies with historic fire frequencies. The map below shows the mean frequency departure for the Inyo NF, expressed as percent of departure in classes. The classes include:

- -95 to -25 percent areas that have more frequent fire – bright blue
- -25 percent to 0 or 0 to 25 percent + areas that have little to no deviation in fire – light blue or tan
- 20 to 40 percent + areas with some fire deficit- yellow
- 40 to 60 percent + areas with high fire deficit - orange
- 60-85 percent + or >85 percent + areas with a very high fire deficit – dark orange/red

The Inyo NF extends as two vertical strips from north to south. The left area extends along the eastside of the crest of the Sierra Nevada. The right side extends along both west and east sides of the White and Inyo Mountains. Most of the White and Inyo Mountains are shown in blue, except for higher elevation portions in the center that are mottled areas of orange. The low elevations are sagebrush, Pinyon-juniper, and xeric shrubland ecosystems, depicted in blue. The same blue patterns with some orange fragments are depicted along the lower slopes of the Sierra Nevada. These blue areas have more frequent fire now than historically. This is due in part to non-native, annual grass invasions (cheatgrass and red brome) that have changed the fire regime. This excess of fire may lead to issues related to native plant and animal distributions, elevated soil erosion, and loss of ecosystem integrity. Across most of the western portion of the forest, below the highest subalpine areas, orange and red is shown. In contrast, all of the forest areas, including Jeffrey pine, mixed conifer, white fir, and some of the lower subalpine forests are depicted as yellow, orange, and red. These are areas where fire has become less frequent, particularly in Jeffrey pine and mixed conifer. This has led to increased fuels, and forest density, causing higher intensity and severity fires. See Chapter 1 of this assessment for more discussion on the natural range of variability of fire severity.



Comparison of current and historic fire frequencies on the Inyo NF

Along with changes in vegetation and fire suppression, human populations have increased and impacted fire suppression and restoration. The greatest areas of wildland urban interface (WUI) occur in sagebrush and Jeffrey pine assessment types, 136,001 and 78,517 acres respectively.

In the Inyo NF Chapter 1 topic paper, the amount of high severity fire from an array of recent fires on the Inyo NF was shown. Some of these fires occurred near or in the WUI, including the McLaughlin Fire and the Birch Fire. These burned near the communities and structures in Swall Meadows and Long Valley.

These types of fires put more firefighters at risk (Stockmann et al. 2010). In 2006, five firefighters were killed protecting WUI structures. In 2003, fifteen people, including one firefighter, were killed in association with the Cedar Fire in southern California. Tragically, this year 19 firefighters were killed while suppressing a fire in Arizona. As a result of these newer findings, the new Cohesive Fire Strategy emphasizes fire adapted communities, fire resilient wildlands, and risk-based fire management.

Future projections indicate that climate will continue to change and magnify the fire risk to communities, as well as increase the likelihood of more intense and faster growing fires in the wildlands (Westerling et al. 2011). Longer fire seasons and drier and hotter fire conditions have already been noted over the last decade (Safford et al. 2012). Moreover, climate models for the southern Sierra Nevada show increased fire probability and impacts to terrestrial ecosystems, including the Inyo NF. See the Inyo NF Chapter 3 topic paper. In a national risk assessment, the Sierra Nevada mountain range and nearby areas in the Great Basin were identified as one of the highest risk areas in the country (Cohesive Strategy 2013). A more refined risk assessment is under development for the Inyo NF, and will be used during forest plan revision.

Fires do not recognize land ownership boundaries. The Cohesive Fire Strategy (2013) recognizes the importance of cooperative relationships among land managers and owners in addressing fire issues. On the Inyo NF, there is good cooperation and initiative among different groups and communities. This includes the Bureau of Land Management, the City of Los Angeles, Southern California Edison, the National Park Service, the Humboldt-Toiyabe National Forests, and county, city and private owners.

Wildland Fire Management

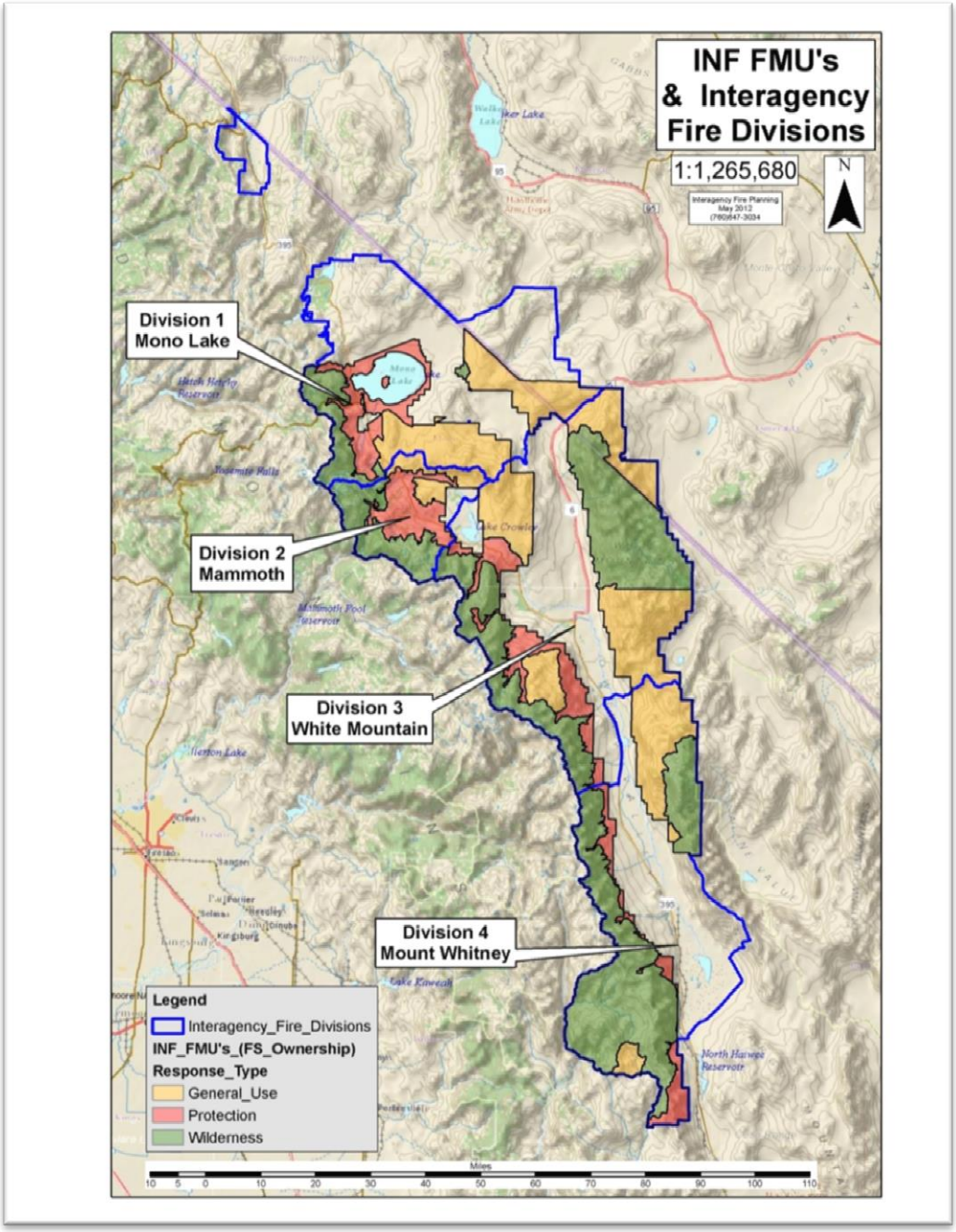
Wildland fire interacts with and impacts the resources on the forest, as well as with the local community, and must therefore be managed. A brief description of the fire management program on the Inyo NF follows to provide context for this assessment.

Inyo NF Fire Management, through a Service First Agreement with the Bureau of Land Management, Bishop Field Office – Owens Valley District (OVD), provides fire management on 3,485,691 acres of private, state and federal lands. The organization provides wildfire: burned area rehabilitation; code enforcement; detection; effects monitoring; emergency response; planning; prevention; public education; suppression repair and training. It also plans and implements prescribed fire and fuels treatments. Federal fire policy recognizes two types of wildland fire: prescribed fire and wildfire. Prescribed fires are planned ignitions, and wildfires are unplanned ignitions or prescribed fires that are declared wildfires. Every wildfire receives a pre-planned response with firefighter and public safety as first priority. A wildland fire may be concurrently managed for one or more objectives and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, topography, varying social understanding and tolerance, and involvement of other governmental jurisdictions having different missions and objectives. These objectives cover a spectrum from resource to protection.

Resource objectives maximize the beneficial effects of fire and typically favor the return or maintenance of fire in its natural role. Protection objectives seek to minimize wildfire loss or damage to high value resources such as homes and habitat. Fuels reduction benefits both.

The local fire management plan (FMP) communicates direction from the LRMP and other local, regional and national policy documents to fire managers. The FMP divides the forest into three fire management units (FMUs): general use; protection and wilderness. Each has different conditions and constraints and receives a different response. General use and wilderness allow resource benefit fire. Fires are suppressed in the protection FMU. Initial action on human-caused wildfire is to suppress at the lowest cost with the fewest negative consequences. The role of wildland fire as an essential ecological process and natural change agent is incorporated into the planning process. Plans are updated as policies and expertise change.

Federal crews, engines, aviation, patrols and overhead have primary initial attack wildland responsibilities in Mono County and on National Forest System lands in Inyo County. Local government fire departments are responsible for structure protection and may assist in other ways. Each county has a community wildfire protection plan (CWPP) and there are 10-15 active fire safe councils.



Inyo NF fire management units and interagency fire divisions

Insects and Pathogens

Insects and fungi are natural parts of the ecosystem. It is only when their effects exceed what is desirable or non-native insects and pathogens disrupt ecological integrity that they become a concern. With the exception of a few introduced insects and pathogens, forests on the Inyo NF have the same insect and disease associates they had 100 years ago. There are some insects that have been important food sources

for Native Americans in the assessment area, and are still valued by the tribes. On the other hand, there are some insects that at times are causing marked tree dieback that are concerns.

There have been several patterns of insect and pathogen impacts on ecosystems on the Inyo NF and surrounding area. They differ between sagebrush, pinyon-juniper, Jeffrey pine, red fir, and subalpine forests. Tree death associated with all of the insect and pathogens rises with drought. Widespread tree death in pinyon and juniper has occurred in recent decades at rates five to ten times higher than expected in the western United States, due to the combined effects of drought, insects, and disease (Shaw et al. 2005). Pinyon ips and black stain root disease are the primary agents on the Inyo NF. Jeffrey pine is affected by both Jeffrey pine and mountain pine beetles. Tree death levels have been extensive in the past around recreation areas, especially of large diameter trees. Mountain pine beetle has caused high levels of tree death in many locations in recent years, impacting Jeffrey pine, lodgepole pine and other subalpine pines. Mountain pine beetle and white pine blister rust have devastated whitebark pine stands in the Rocky Mountains causing whitebark pine to be listed as a candidate species under the Endangered Species Act. See Chapter 5 of this assessment. High levels of limber pine mortality were observed during the late 1980s and early 1990s on the Inyo NF (Millar et al. 2012). Fir engraver beetle causes increases in red fir death, especially in combination with root rot. The National Insect and Disease Risk Map model indicates that over 38,000 acres are estimated to lose more than 25 percent of the standing volume over the next 15 years due to insects and diseases. Going back several thousand years, protracted droughts over several decades or centuries have been surmised. In addition, warming temperatures have increased the probability of bark beetle outbreaks in the near future, especially in high elevation, pine-dominated forests (Meyer 2013a, 2013b, Hicke et al. 2006).

Invasive Invertebrates and Fungi

More information on aquatic invasive species is described in Chapter 1 of this assessment.

White pine blister rust has impacted white pines in the bio-region for decades, but has not been detected on the Inyo NF. For more information on its impacts to native trees, and role in the federal listing of whitebark pine as a candidate species under the Endangered Species Act, see the discussion on natural range of variability in Chapters 1 and 5 of this assessment.

Throughout its native range, populations of Mountain yellow-legged frog are mostly in decline, with chytrid fungus a primary stressor. See Chapter 5 of this assessment for more specific information. Trout of hatchery origin in streams can influence wild populations by introducing disease.

Landslides, Avalanches, Earthquakes, Geothermal Heating, and Wind

Earthquakes and landslides are covered in Chapter 10 of this assessment. Avalanches include both snow movement and “debris” flows. Debris in this case means rock, mud, and soil.

Recent debris flows have caused major ecosystem changes in the eastern escarpment of the Sierra Nevada and Owens Valley. See Chapters 2 and 10 of this assessment for more detail. Often, they occur following fires when vegetation has burned, soils are left exposed, and heavy rainfall follows. Two notable debris flows were the Oak Creek debris flow in 2008 and the Haiwee Creek debris flow in 2010.

Periodically, there have been tree die-offs in subalpine forests in the Mammoth Lakes Basin that resulted from carbon dioxide vents in this geothermally active area. Hot springs also result from geothermal heating and support small, unique aquatic and riparian ecosystems.

Windthrow is when trees are blown over and usually die. In most years when this happens, it is limited to small areas and several trees. Sometimes, very high winds occur on the eastside of the Sierra Nevada, such as happened in December 2011. This event produced several hundred acres of wind-fallen trees across large patches, mostly in red fir and subalpine forests. This greatly increased fuel loads. Wind is an important process that has shaped and maintains sand dune areas in the Mono Valley and Bodie Hills-Excelsior Mountains.

Vegetation Succession, Land Use and Management

Succession is defined as the progressive, broadly predictable replacement of species by other species over time in an ecosystem, usually in reference to the period following a disturbance, such as fire. Historically, fire played an important role in shaping vegetation succession. Fire shaped landscape amounts and patterns of pinyon-juniper, aspen, and sagebrush. It kept vegetation density low and more variable and favored dominance by fire resilient species, such as Jeffrey pine. Native Americans used fire to benefit food sources and life necessities such as basketry materials. This interaction changed dramatically with European settlement.

Vegetation management can be considered both a driver and stressor to ecosystems. Changes in land use have shifted over time from early settlement activities, fire suppression and timber harvest in the early and middle part of the 20th century. Over the last 30 years, more emphasis has been placed on protecting the wildland urban interface, wildlife habitat and other land uses such as recreation. All of these changes have affected vegetation succession. This history of vegetation management is important to understanding current patterns of vegetation succession and future trends.

Native American Management

Several Native American tribes have lived in the assessment area for thousands of years, including the Owens and Mono Valley Paiutes, and the Shoshone. They actively managed vegetation and utilized fire across portions of the landscape prior to European settlement. Their management included hunting, gathering, irrigation, and burning (Anderson 1997, Anderson and Moratto 1996).

European Settlement

European settlement in the mid-1800s brought several key changes to the area affecting succession. This included disruption of Native American traditional management, intense grazing, agriculture, mining and logging.

The influx of Euro-American settlers to California in the 1800s, with hundreds of thousands of sheep and cattle, created a significant impact on the landscape, through alterations to plant cover, soil erosion, and streambanks (Rowley 1985). Grazing during that time was very intense and not as carefully managed as it is now. The initial establishment of invasive annuals in the 1850s has been linked to the introduction of livestock (Chambers et al. 2007). Intensive grazing removes herbaceous plant cover, thereby influencing fine fuels and the fire regime.

Timber harvest primarily occurred in the Owens Valley and Mammoth Lakes vicinity or other areas associated with mining or other settlement needs. Pinyon, and to a lesser extent juniper, were used for fuel in areas close to mines during historic era (Young and Svejcar 1999). Jeffrey pine was also logged.

For more detailed information see the Natural Range of Variability Assessments (Safford 2013, Slaton and Stone 2013a and 2013b, Meyer 2013a and 2013b).

Management from the 1930s to 1980s

There were two big changes in management that affected vegetation succession in the early and mid-1900s. First was fire suppression. Second was rangeland improvement for grazing. In addition, grazing and logging continued but began to change.

Over the last century, with good intent but unforeseen consequences, most fires have been rigorously and successfully suppressed (McKelvey et al. 1996). The outcomes of fire suppression were discussed above, and include increased tree density in Jeffrey pine and mixed conifer forests, and potential contribution to expansion of pinyon-juniper into sagebrush shrublands.

Current Management

Current management has changed substantially. Vegetation management for wildlife habitat improvement, ecological restoration, and reducing fire hazard in the wildland urban interface (WUI) are the primary focus.

There has been an increase in efforts to remove trees and other fuels through cutting and prescribed fire in order to reverse expansion into shrubland sites, for ecological restoration, and to promote wildlife dependent on sagebrush shrublands. Some thinning of Jeffrey pine forests in the WUI has occurred, with much of the material going for use as fuelwood. There is no longer overstory removal. Recreation affects vegetation succession in localized areas and depending on intensity.

See Chapters 8 and 9 of this assessment for more information on vegetation management, grazing, wildlife management and recreation.

Mechanical treatment and restoration activities of all kinds have occurred primarily at middle elevation areas on the Inyo NF. Thinning has occurred on about 1,555 acres. Mastication, mowing or chipping have occurred on about 391 acres. Just over 4,100 acres had yarding of fuels or piling. Prescribed burning has occurred on about 16,581 acres, either as piles or broadcast burning. Some of these areas overlap with the thinned areas and others are separate. Additional restoration has come from wildland fire managed for resource benefit, which has included over 12,824 acres.

Most of the thinning is funded by stewardship or other contracts for fuelwood. There are no mills in the southeastern Sierra Nevada. These limited markets make it difficult to accomplish mechanical thinning for restoration of lower forest densities. See Chapter 8 of this assessment for more detailed information.

Contribution the Plan Area Makes to Ecological, Social or Economic Sustainability

In 2004, the Forest Service produced a national report on Sustainable Forests (USFS 2004). That report included a summary of the current condition of forests, based on a variety of ecological, social and economic indicators of sustainability. Ecological sustainability can be defined as:

> ...the capacity of forests, ranging from stands to ecoregions, to maintain their health, productivity, diversity, and overall integrity, in the long run, in the context of human activity and use.

There are two main facets to evaluating the sustainability of ecosystems: drivers and the effects of stressors are operating within the natural range of variability, and ecosystems are "resilient" to drivers and stressors. That means that they can have effects from drivers and stressors but continue to function and recover. Climate, fire, insects and pathogens, invasive species, vegetation succession, and vegetation management all occur simultaneously on the landscapes of the Inyo NF. They influence each other. Fire affects vegetation succession. Vegetation succession affects insects and pathogen levels. Climate affects fire, vegetation succession, insects and pathogens, and invasive species. When considering ecological sustainability as influenced by drivers and stressors, it is important to consider them all together.

Natural Range of Variability

Ecosystems on the Inyo NF vary in their comparison with the natural range of variability. In the table below, the conditions of these drivers and stressors are summarized using similar elements as described in the National Report on Sustainability (2004, 2010). The trend is for some characteristics to continue to deviate from the natural range of variability, and to deviate more because of the low rate of restoration vegetation management. This includes fire managed for resource benefit.

Summary of conditions of drivers and stressors

Characteristic	Condition	Trend
Area affected by insects and pathogens beyond natural range	Historic extent of insect and pathogen outbreaks is unknown. Dense forests and climate change increase susceptibility to large outbreaks.	Expected to continue, with climate change potentially contributing to new and larger outbreaks.
Area affected by air pollutants that may cause negative effects	Good to moderate. The Sierra Nevada Mountains block much of the poor air quality in the San Joaquin basin from reaching the forest.	Continued, although some air control measures have improved conditions some.
Area affected by invasive species	Poor in basin and lower elevation areas, extensive non-native grasses.	Continued. Difficult to restore. Climate change enhances invasions.
Area with fire condition class outside of natural range	Outside of range in some ecosystems, with fire occurring less frequently now than in the past in Jeffrey pine and mixed conifer, but more frequently in xeric shrublands. Subalpine/alpine are within the range of natural variability.	Continued. Restoration far below rates needed to restore. Warming and longer fire season is making problem worse.

See the Natural Range of Variability papers by Slaton and Stone (2013a, 2013b) and Safford (2013).

Resilience

Ecosystem resilience can be difficult to characterize. In essence, it is the ability of an ecosystem to absorb changes from drivers and stressors and still maintain function (biodiversity and processes such as carbon cycling). Predicted trends are that climate will continue to change and magnify the fire risk to communities, as well as to increase the likelihood of more intense and faster growing fires in the wildlands. See the Inyo NF Chapter 3 topic paper. Longer fire seasons, and drier and hotter fire conditions have already been noted over the last two to three decades.

In the sagebrush and Pinyon-juniper ecosystems, invasive grasses and other plants have become established in many areas on the Inyo NF and nearby areas. Invasive species may be enhanced by climate change. These invasive grasses change the fire regime. Invasive annual grasses shift the fire regime to a more frequent one. This in turn hinders recovery of native plants and reduces habitat value for native animals such as deer or sage-grouse.

Information gaps

Information gaps for drivers and stressors are similar to those covered in Chapter 1 of this assessment, and are not repeated here.

Chapter 4: Assessing Carbon Stocks

Forests play an essential role in global carbon storage, by removing carbon dioxide (CO_2) from the atmosphere and by storing carbon as biomass within ecosystems. Increases in atmospheric CO_2 over the last century have been linked to rising temperatures, and because forests absorb CO_2, they play an important role in regulating climate. In turn, changes in climate, including precipitation and temperature, influence the rates of carbon uptake and loss from an ecosystem. As a result, it has become increasingly important to understand the feedback mechanisms between carbon uptake and forests to ensure the maintenance of healthy and productive ecosystems.

Carbon stock is a term used here to describe the total pool of carbon in an area, including live and dead biomass, and above and below ground carbon. Atmospheric CO_2 is specifically addressed in Chapter 2 of this assessment, and is considered here only as it is linked to forest carbon stocks. Other issues that influence carbon stocks, including the harvest of wood products, fire, disease, and climate, are covered in more detail in other chapters of this assessment. In this chapter, the focus is on assessing the issues that associate carbon stocks with climate change.

Important Information Evaluated in this Phase

The information in this chapter is a summary of the Inyo NF Chapter 4 topic paper. The assessment was conducted for lands administered by the Inyo NF. Depending on the available information, conditions and trends for carbon stocks were assessed at the forest-wide scale, at the scale of broad vegetation zones such as forested lands, shrublands, and meadows, and at the scale of assessment types as used in other chapters of this assessment.

The findings of this assessment were conducted through a review of the published literature on carbon stocks that was applicable to the assessment area. Because most information came from studies conducted outside the assessment area, some inference was required to determine applicability to the Inyo NF.

Nature, Extent and Role of Existing Conditions and Future Trends

A comprehensive review of the carbon cycle can be found in Janzen (2004). In summary, CO_2 in the atmosphere is absorbed by vegetation, which converts CO_2 to biomass in the process of photosynthesis. The carbon present in biomass, including leaves, stems, and roots, is in turn converted to litter and dead wood. Carbon dioxide is emitted back into the atmosphere by plants and animals during the process of respiration, and is released from microbes that decompose litter and dead wood. Carbon can also be removed from an ecosystem by wood harvesting, grazing, fire, transport of soil and litter in streams or floods, and by the transport of soluble carbon molecules in soil.

The term carbon sequestration as used here refers to the process of carbon uptake and storage that is carried out primarily by vegetation and is the focus of this chapter. Mean existing carbon stocks from 1986 to 2005 were simulated by Bachelet et al. (2001) using the MC1 dynamic global vegetation model. A summary by assessment type on the Inyo NF revealed that the greatest carbon stocks occur in upper elevation systems, including subalpine forest, red fir, and alpine ecosystems. However, the interpretation of this dataset is limited by the fact that it covers only the western portion of the Inyo NF and excludes the east side, or 35 percent of Inyo NF lands. To account for this data gap, total carbon in each assessment type was estimated by multiplying mean carbon per unit area by the spatial extent of the assessment type. These results show that the sum of contributions by mountain mahogany, sagebrush, and xeric shrublands and blackbrush amount to 29 percent of the current above-ground carbon stocks on the Inyo NF. The table below shows current carbon stocks (g C/m2, 1986-2005) on the Inyo NF, summarized by assessment type. Totals are in units of teragrams (Tg).

Current carbon stocks on the Inyo NF

Assessment Type	Min	Max	Range	Mean	STD	Area on Inyo NF (acres)	Total
Alpine	4315	15222	10907	11381	2612	129805	5.98
Jeffrey pine	557	12276	11720	7269	2735	135086	3.97
Mountain mahogany	1109	12424	11314	6425	3104	81655	2.12
Pinyon-Juniper	112	12643	12531	2427	3080	561022	5.51
Red fir	683	15719	15036	9899	4134	118039	4.73
Sagebrush	81	15593	15512	3527	4212	308410	4.40
Special type	1243	14145	12902	5582	4354	52784	1.19
Subalpine forest	205	17867	17662	8547	5155	383336	13.26
White fir	736	5711	4975	2307	1581	45671	0.43
Xeric shrublands and blackbrush	89	789	700	248	212	213722	0.21

Current condition of these carbon stocks on the forest is strongly influenced by the proportion in forested lands as opposed to shrublands and meadows. Many of the drivers and stressors discussed in Chapter 3 of this assessment, including ecological succession, species migration, and biological invasions, have altered these proportions on the landscape. For example, the proportion of trees to shrubs or herbaceous vegetation is altered through the upward movement of tree line with changing climate, encroachment of shrubs into meadows, and the rate of shrub and tree regeneration following fire.

A nationwide study of carbon stocks in live and dead trees, understory vegetation, forest floor, and down dead wood was conducted by Heath et al. (2011), and summarized by National Forest System (NFS) region and forest. This study found that the Inyo NF had the overall lowest forest carbon density out of the ten national forests in the bio-region. An important caveat of this finding is the small size of the dataset available for model calibration for the assessment area, and the fact that a large proportion of the Inyo NF is occupied by non-forested lands.

More than one-quarter of the Inyo NF is dominated by shrublands, including sagebrush, xeric shrublands, blackbrush, and mountain mahogany. Meyer (2012) summarized findings regarding carbon storage in cold desert shrublands, which correlate roughly with the sagebrush and xeric shrublands and blackbrush assessment types. The deep rooting systems and high root-to-shoot ratios of these ecosystems results in large carbon reserves, despite the fact that productivity in these areas is low compared to most forested lands, and that their role in the carbon cycle is assumed to be minor. Soil carbon dominates the terrestrial carbon pool, exceeding carbon stocks held in plant biomass nearly five-fold (Janzen 2004). Hunt et al. (2004) found that sagebrush shrublands in Wyoming are carbon sinks, gaining 30 g/cm/year, compared to grasslands, which had a net ecosystem exchange rate for carbon of zero.

Similar to shrublands, meadows may play a significant role in the carbon cycle, primarily due to their extensive below ground biomass. The role of meadows in the carbon cycle is also magnified because of greater soil moisture compared to surrounding landscapes, which is correlated to greater ecosystem productivity and respiration (Norton et al. 2006). Finally, human uses that are concentrated in meadows, such as grazing and water diversion, may impact soil carbon in these systems.

The Natural Resources Conservation Service (NRCS) soil survey data shows that soil organic carbon is highest in special types, which includes dry to wet meadows, aspen, and water birch. Subalpine forests and Jeffrey pine also have high soil organic carbon, but it is notable that shrublands such as sagebrush and mountain mahogany exceed some forested types in terms in soil organic carbon. This reflects the higher proportion of below ground to above ground biomass in these ecosystems, as compared to forests. When accounting for the total acreage of each assessment type on the Inyo NF, the contribution of non-forest ecosystems, including all shrublands, alpine, and special types, amounts to an estimated 47 percent of the forest soil organic carbon pool.

Looking at trends in carbon sequestration, a Forest Service study conducted an assessment of carbon sequestration capabilities of the national forests in California over the next 100 years (USFS 2009). The assessment analyzed forest growth, disturbance, and management options under a range of management scenarios for the national forests in California. The analysis concluded that under then current (2009) forest management activities, over the next four to six decades, California's national forests will accumulate carbon at a higher rate than carbon will be lost. This will be at a decreasing rate because of increased carbon loss through disturbances such as wildfire, insect and disease related pest mortality and inter-tree competition. However, at some point in the mid-21st century, carbon losses from wildfire, disease and other disturbances will exceed sequestration, and national forests in California will become net emitters of carbon. The table below summarizes the drivers and stressors expected to influence these trends.

Drivers and stressors influencing carbon trends on California national forests

Driver/Stressor	Influence on carbon stocks
Climate	Temperature and precipitation affect photosynthesis, respiration, and decomposition
Ecological succession	Early successional stages may have a greater rate of carbon uptake, but later successional stages store greater total carbon
Species Migration	Increasing tree:shrub ratios change carbon uptake patterns
Invasions	Increase in annual grass cover reduces fire return interval
Hydrology	Erosion and stream incision transport carbon to and from ecosystems
Soil quality	Nutrient cycling rates influence soil carbon storage
Air quality	Pollutants like ozone influence carbon uptake by vegetation; nitrogen deposition influences nutrient cycling
Disturbance - fire	Fire size, severity, and frequency influence carbon loss
Disturbance - insect/disease	Vegetation mortality affects carbon cycling
Disturbance - geomorphic	Floods and debris flows transport carbon to and from ecosystems
Disturbance - wind	Extreme wind events influence fire behavior and fuels profiles
Disturbance -grazing	Causes changes to aboveground and belowground carbon pools
Disturbance - logging	Timber harvest both removes trees and increases tree growth
Population growth	Results in increased carbon emissions and demand for forest uses
Roads and motorized use	Motorized use is correlated to carbon emissions, and routes can influence soil carbon storage

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

The forests of the bio-region will play an important role in helping California meet its greenhouse gas emission reduction goals. Currently, these forests store a large quantity of carbon in living biomass, standing and downed woody debris, litter and soil organic carbon. Markets for carbon do exist and therefore a price for carbon has been established and can be used to value this sequestration. A central element of California's Global Warming Solutions Act (AB 32) is a cap and trade program now underway, which allows the state to distribute carbon allowances as tradable permits.

Forest management can affect by controlling stand structure, composition and growth rates, as well as by influencing the frequency, size and severity of natural disturbances that may reduce or enhance current inventories. A recent study determined that this carbon sequestration is largely dependent the frequency and extent of wildfires in the bio-region. As a result, without an increase in the pace and scale of ecological restoration, it was estimated that the forests of the bio-region will become net emitters of carbon sometime around the middle of the 21st century. Therefore, increased pace and scale of restoration to reduce fire disturbances will be critical in maintaining the long term value of carbon sequestration (USDA Forest Service 2009).

In addition, restoration can contribute to economic and social wellbeing by providing opportunities for wood product activities. According to the Intergovernmental Panel on Climate Change (IPCC) “When used to displace fossil fuels, wood fuels can provide sustained carbon benefits, and constitute a large

mitigation option" (Nabuurs et al. 2007 p.551). A recent study estimates that forests in the United States are capable of sustainably producing 368 million dry tons of wood per year, with 41 million dry tons from currently unused logging residues and 60 million dry tons from hazardous fuel treatments (Perlack et al. 2005). If applied to bioenergy production, this wood residue could offset a substantial percentage of the country's CO_2 emissions from fossil fuels (Richter et al. 2009).

Information Gaps

A sufficient dataset of direct measurements of carbon within the Inyo NF was a data gap in the development of this assessment. In addition, some datasets included models of the west half of the forest (Sierra Nevada and Glass Mountains), but excluded the east half (Inyo and White Mountains and Pizona area).

Chapter 5: At-Risk Species

At-risk species are defined as: 1) the federally recognized threatened, endangered, proposed, and candidate species; and 2) species of conservation concern known to occur within the plan area. The list of at-risk species is identified by the Regional Forester in coordination with the Inyo NF Supervisor. Species of Conservation Concern are identified using the NatureServe ranking system to highlight species that have a substantial concern about their capability to persist over the long term in the plan area, considering local information and local conditions. A detailed process to identify the potential species of conservation concern is provided in the proposed Forest Service Handbook directives (USDA USFS 2013, proposed FSH 1909.12 Section 12.5) and is described in the Inyo NF Chapter 5 topic paper. For this assessment, the list of species of conservation concern is purposefully called a "potential" list, because it can be refined to add or remove species through the plan revision process.

The purpose of identifying at-risk species is to help develop forest plans that maintain the diversity of plant and animal communities and provide for the persistence of native species in the plan area (36 CFR 219.9). Most species will be maintained by plan components (desired conditions, objectives, standards, guidelines, and suitability of lands) that provide for broad ecosystem integrity and ecosystem diversity. Some species may require additional species-specific plan components, particularly to help in recovering federally recognized species or where the species requires unique and specific ecological conditions that are best addressed with more focused plan components. Additionally, the 2012 Planning Rule recognizes that it may not be possible to maintain a viable population of some at-risk species within the plan area due to circumstances beyond the authority of the Forest Service or due to limitations in the inherent capability of the land. Examples might be migratory species where viability is primarily affected in other locations, temperature sensitive species affected by warming temperatures, or where the plan area has limited ecological capacity to provide sufficient habitat to sustain the species.

Important Information Evaluated in This Phase

Information on potential at-risk species came from a variety of sources. Species account information was developed by Forest Service personnel and included a variety of sources. See the Inyo NF Chapter 5 topic paper and appendices. Species occurrence information was gathered from the California Natural Diversity Database (CNDDB), Nevada Natural Heritage Program (NNHP), Forest Service Natural Resource Information System (NRIS), the Consortium of California Herbaria (2013), the California Native Plant Society Inventory of Rare and Endangered Plants, and the Jepson Manual (Baldwin et al.

2012). Terrestrial wildlife species' ranges were determined using the California Wildlife Volumes I, II, and III developed by the California Department of Fish and Wildlife (Zeiner et al. 1990). In addition, some information was provided by individual sources such as botanists or butterfly collectors or researchers, and scientific literature. Conclusions on the ability for a species to persist within the plan area was determined using the best available scientific information for the species or if information was specifically known for the Inyo NF. Information was also used from previous species reviews such as the 2013 Regional Forester's Sensitive Species List, the 2006 and 2013 Inyo NF Sensitive Species Lists, and the 2006 Inyo NF Plant Species Watch List. Some information was contained in local files by Forest Service biologists and botanists and other resource specialists.

The Inyo NF has used the best available information possible to determine current population trends. The scale of this information may be forest-wide, range-wide, or at the scale the information was available. The forest assumes the trend in populations for the given range is the same for the forest-scale.

The Bio-Regional Living Assessment and the Science Synthesis were used when applicable to describe current conditions and trends for terrestrial wildlife. The Forest Terrestrial Ecological Unit Inventory (TEUI) (USDA INF 2012a), particularly the Potential Natural Vegetation (PNV) component of the TEUI, is used when discussing terrestrial wildlife habitat conditions and trends. The TEUI or PNV is referenced if more information is needed for a specific habitat component associated with terrestrial wildlife.

Risk factors, and trends related to habitats and ecological conditions were derived from Chapters 1, 2 and 3 of this assessment, as well as species account information. Conditions and trends for human-related stressors such as habitat fragmentation from encroachment and development, and disturbance from recreation and other uses of the forest are described in more detail in Chapters 6, 7, and 9 of this assessment. This summary information is not intended to be complete regarding a species life history, but is an overview to highlight key ecological conditions and status and trends for each species. The full suite of readily available information relevant to at-risk species will be considered when developing and evaluating plan components throughout plan revision.

Nature, Extent and Role of Existing Conditions and Future Trends

Federally recognized species under the Endangered Species Act (ESA) and species of conservation concern are two distinct components of at-risk species. They each play a role in informing the development of plan components. National forests are managed to contribute to the recovery of federally listed species and to not jeopardize listed species or their habitats. Plan components are developed to provide the ecological conditions necessary to maintain a viable population of species of conservation concern within the plan area. This assessment will briefly describe three key factors for each federally listed species:

- species status on the Inyo NF
- key ecological conditions needed to support the species
- key risk factors that affect the species

Indicators were used for assessing the current conditions for the distribution of the species, abundance of the species, population trends, habitat quality, habitat distribution, and habitat connectivity. More details on specific indicators by species are found in the Inyo NF Chapter 5 topic paper.

Federally Recognized Species

On the Inyo NF, there are ten species federally recognized as threatened, endangered, proposed, and candidate species. They are separated into the following life form groups: fish; amphibians and reptiles; birds and mammals; invertebrates; and plants.

Fish, Amphibians and Reptiles

Federally recognized fish, amphibians and reptiles

Common Name	Scientific Name	Status
Owens tui chub	*Siphateles bicolor snyderi*	Endangered
Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	Threatened
Paiute cutthroat trout	*Oncorhynchus clarkia seleniris*	Threatened
Mountain yellow-legged frog	*Rana muscosa*	Proposed
Sierra Nevada mountain yellow-legged frog	*Rana sierrae*	Proposed
Yosemite toad	*Anaxyrus canorus*	Proposed

Owens tui chub

Species Status on the Inyo NF

The Owens tui chub is endemic to the Owens River Valley. This species historically thrived in the Owens River and associated tributaries along the valley floor. Today, Owens tui chub occurs in only six locations (USDI-USFWS 2009) and is restricted to less than one percent of its native range. Within the planning area tui chub occur at two locations, Little Hot Creek Pond (man-made) and Sotcher Lake (outside the native range of the species). Owens tui chub populations are small and isolated from one another. This species was abundant throughout the Owens Valley but existing populations may only consist of up to a few hundred fish. No recent counts have been conducted.

Key Ecological Conditions Needed to Support the Species

Habitat. Open water in ponds and lakes and associated streams and pools. This species is limited to two known locations.

Key Risk Factors

Non-native fish. Mosquitofish, which prey on eggs and fry of tui chub and compete with adults for habitat exist in Little Hot Creek. Non-native trout exist in Sotcher Lake.

Genetic diversity. Limited populations with no natural connectivity between populations threaten genetic diversity. Small populations are subject to inbreeding effects and are at high risk of extirpation (local extinction) due to single events such as drought.

Sediment. Sedimentation is causing filling and pond succession in Little Hot Creek pond. This is leading to the pond filling and becoming more vegetated and marsh-like which is not ideal habitat.

Lahontan cutthroat trout

Species Status on the Inyo NF

Lahontan cutthroat trout are not native to the forest, but a refuge population was established in O'Harrel Creek by an unknown source, and later discovered by California Department of Fish and Wildlife personnel in the 1970s. Lahontan cutthroat trout have been extirpated from much of their native range. The amount of suitable habitat is likely contained within a 0.5 mile reach of stream with 0.2 miles of that occurring on Los Angeles Department of Water and Power (LADWP) land. Periodic population counts have occurred (8 out of 14 years) by the California Department of Fish and Wildlife finding the O'Harrel Creek population continues to persist but has been declining.

Key Ecological Conditions Needed to Support the Species

Isolation. Lahontan cutthroat trout do not compete well with other trout species and rarely co-exist when non-native trout are introduced. In some locations, they can hybridize with non-native rainbow trout (Behnke 1979). Currently, physical barriers limit upstream movement of non-native rainbow trout and brook trout are not a threat.

Cold water. Lahontan cutthroat trout require water temperatures less than approximately 55 degrees Fahrenheit during the spring and summer egg incubation period (USDI - USFWS 1995). Adults can withstand greater fluctuations in temperature, and do best in water temperatures that are less than 68 to 72 degrees Fahrenheit.

Key Risk Factors

Non-native trout. The illegal movement of rainbow trout or brook trout could reduce population number through competition.

Climate change. Warming temperatures, changes in timing of snowmelt, and intensity of floods are a concern because of the trout's vulnerability to increased stream temperatures and changes in flows.

Fire. Sedimentation of spawning gravels as a result of fire in the basin is a concern.

Paiute cutthroat trout

Species Status on the Inyo NF

Paiute cutthroat trout are not native to the Inyo NF. Although much information is available regarding the species' needs and trends within its native habitat, this discussion will focus primarily on the populations and habitats on the forest. In an effort to conserve this species, the California Department of Fish and Wildlife established two populations in the White Mountains on the Inyo NF in Cabin and North Fork Cottonwood Creeks. The Cabin Creek population occupies approximately 1.5 miles of stream and the North Fork Cottonwood Creek population occupies 3.4 miles of stream. Visual surveys by California Department of Fish and Wildlife biologists regularly identify 100-200 individuals in each creek. Both populations on the forest appear to be stable based on recent visual observations. Populations within the plan area will likely remain stable and habitat conditions will continue to improve under existing management direction.

Key Ecological Conditions Needed to Support the Species

Suitable stream habitat. The Paiute cutthroat trout recovery plan identified that "adult fish prefer stream pool habitat in low gradient meadows with undercut or overhanging banks and abundant riparian vegetation" (USDI – USFWS 2004, p. iii).

Key Risk Factors

Spawning gravel recruitment. Spawning gravel is limited in the North Fork Cottonwood Creek. Past habitat improvements have added gravel but it's been determined that without a natural source, periodic inputs will be required.

Genetic diversity. Limited populations threaten genetic diversity. Small populations are subject to inbreeding effects and are at high risk of local extinction due to single events such as drought.

Climate change. Warming temperatures, changes in timing of snowmelt, and intensity of floods are a concern because of the trout's vulnerability to increased stream temperatures and changes in flows.

Livestock grazing. Livestock grazing is not currently a key risk factor, but the Cabin Creek population is within an active, but vacant grazing allotment.

Mountain yellow-legged frog

Species Status on the Inyo NF

Mountain yellow-legged frogs inhabit lakes, spring ponds, and streams from 5,000 to 11,000 feet above sea level in the southern Sierra Nevada. This species has been eliminated throughout much of its native habitat and existing information suggests the species occupies less than five percent of its historical range in California (Vredenburg et al. 2007). On the forest, the native range of Mountain yellow-legged frogs was limited to the Kern Plateau., the native range of the California golden trout. Historically, the species was likely found throughout the Kern Plateau in side channels, spring pools, pond habitat and possibly backwater ponds created by beaver dams in areas separated from fish habitat. Today, they are only found in small areas in Bullfrog Meadow and in Mulkey Meadows in an abandoned beaver dam pool. Interestingly, Mulkey Creek was the only stream on the Kern Plateau that did not contain trout prior to European settlement, and California golden trout were introduced into Mulkey Creek in the late 1800's. This is the only remaining population on the forest and likely consists of fewer than 40 adults (personal observation and Erdman personal communication, CDFW). Suitable habitat on the forest is likely further restricted by the presence of a fungal pathogen commonly referred to as chytrid fungus, which has been linked to significant population declines and local population loss. Several populations on the Kern plateau have recently disappeared and chytrid fungus is the suspected cause. The population within Mulkey Meadow has tested positive for the presence of chytrid fungus. Since the widespread Pacific chorus frog serves as a reservoir for chytrid fungus, once an area is infected it is generally considered to no longer provide sustainable habitat (Reeder et al. 2012).

Key Ecological Conditions Needed to Support the Species

Deep water in high elevation lakes and streams. Suitable habitat conditions for this species depend on sufficient perennial water to meet the needs of each life stage. Adjacent streambank and lakeshores

provide a range of habitats. At lower elevations the frogs occurred in naturally fishless streams. At higher elevations, deeper fishless lakes provide a range of habitat.

Key Risk Factors

Non-native fish. Trout introduced into lakes and naturally fishless streams are cited as a primary factor causing loss of habitat for this species. They also cause fragmentation of habitat.

Disease. Chytrid fungus has caused further declines in the remaining frog population, causing mass population die-offs in localized areas. Chytrid fungus causes mutations and other issues with frogs, preventing them from eating or developing properly.

Climate change. This species requires enough perennial water to resist freezing during winter months and water that serves as breeding habitat. Changes in snowpack and season and timing of rain and snow can affect summer water levels and depth.

Fragmentation of populations. The majority of populations are small and isolated, increasing the risk that the loss of populations will create barriers to genetic mixing and other genetic risks inherent to small populations.

Sierra Nevada mountain yellow-legged frog

Species Status on the Inyo NF

In the Sierra Nevada Mountains, Sierra Nevada mountain yellow-legged frog has been extirpated from much of its native range and currently occupies several scattered lakes throughout the eastern Sierra Nevada from the Independence drainage north to the forest boundary. Based on Vredenberg et al. (2007), the species may occur in five to ten percent of its historic range but five percent or less seems more likely considering the ongoing decline. Recent efforts by California Department of Fish and Wildlife (CDFW) have identified 29 population centers that are occupied on the forest. The size of these population centers range from a few frogs to over a hundred adult frogs.

Key Ecological Conditions Needed to Support the Species

Deep water in high elevation lakes and streams. Suitable habitat conditions for this species depend on sufficient perennial water to meet the needs of each life stage. Adjacent streambank and lakeshore habitats affect water attributes and must be considered for conditions and trends.

Key Risk Factors

Non-native fish. Trout introduced into lakes and naturally fishless streams are cited as a primary factor causing loss of habitat for this species. They also cause fragmentation of habitat.

Disease. Chytrid fungus has caused further declines in the remaining frog population, causing mass population die-offs.

Climate change. This species requires deep perennial water that serves as breeding habitat and overwintering protection from lake freezing. Changes in snowpack and season and timing of rain and snow can affect summer water temperatures and depth, as well as lake freezing in the winter.

Fragmentation of populations. The majority of populations are small and isolated, increasing the risk that the loss of populations will create barriers to genetic mixing and other genetic risks inherent to small populations.

Yosemite toad

Species Status on the Inyo NF

Yosemite toads are found in wet meadow habitats and lake shores surrounded by lodgepole or Whitebark pines. They are most often found in areas with thick meadow vegetation or patches of low willows. The current range of the Yosemite toad, in terms of overall geographic extent, remains largely similar to the historical range. However, within that range, toad habitats have been degraded and may be decreasing in area (USDI-USFWS 2013). There are 22 sites, with 276 known Yosemite toad locations, on the Inyo NF. Populations are found in the higher elevations of the forest from the Lundy Canyon area south to the Piute Pass area. Of these 276 locations, 238 (or 86 percent) are located within designated wilderness areas and 38 are found outside designated wilderness.

Key Ecological Conditions Needed to Support the Species

Wet meadows and lake shores in lodgepole or Whitebark pine forests. Suitable habitat conditions for this species depend on thick meadow vegetation or patches of low willows within wet meadow habitats surrounding lake shores.

Key Risk Factors

Climate change. The warmer and drier weather patterns may lead to direct loss of moist meadow systems suitable for occupancy. Changes in temperatures may also affect virulence of pathogens to a different degree than the immune systems of amphibians and may make Yosemite toads more susceptible to disease (USDI – USFWS 2013).

Livestock grazing. Although listed as a threat by the U.S. Fish and Wildlife Service (2013), there are no livestock grazing allotments within Yosemite toad habitat.

Pack stock use. The Inyo NF has reduced or eliminated the impacts of pack stock grazing within Yosemite toad breeding areas by prohibiting pack stock grazing in these areas.

Birds and Mammals

Federally recognized birds and mammals

Common Name	Scientific Name	Status
Sage-grouse (Bi-State DPS)	*Centrocercus urophasianus*	Proposed
Sierra Nevada bighorn sheep	*Ovis canadensis sierrae*	Endangered

Sage-grouse (Bi-State Distinct Population Segment)

Species Status on the Inyo NF

Sage-grouse in the Bi-State Distinct Population Segment occur throughout the eastern California and western Nevada border region. The BLM Bishop Field Office and Carson Field Office, Inyo NF, and Humboldt-Toiyabe NFs are the primary land managers of occupied sage-grouse habitat. Portions of the Bodie, South Mono, and White Mountains Population Management Units cover the Inyo NF. These areas are delineated around identified sub-populations of bi-state sage-grouse. The Inyo NF manages approximately 427,190 acres (23 percent) of a total of 1,867,350 acres of proposed critical habitat. It should be noted that not all of the acreage identified as proposed critical habitat is suitable for sage-grouse use. Primary constituent elements (PCEs) identify elements of critical habitat that are essential for sage-grouse. The population of sage-grouse within the bi-state area is considered stable and rising in some portions of the area. Due to increased survey efforts over the last two years, sage-grouse have been observed in several new locations, specifically breeding grounds, including some locations not near the core populations in the Bodie and Long Valley areas. These new areas are not on the Inyo NF.

Key Ecological Conditions Needed to Support the Species

Sage-grouse in California are dependent on specific sagebrush habitats, primarily involving two species of sagebrush, *Artemisia tridentata* and *A. arbuscula* (Schroeder et al. 1999, Hall et al. 2008). A diversity or mosaic of sagebrush with native forbs and grasses are needed with different preferences for lekking (breeding display areas), nesting, molting, and wintering.

The Inyo NF has implemented a sage-grouse interim policy that allows for consistent management across the forest when conducting or approving activities within sage-grouse habitat on forest lands (USDA-FS 2012b). This document uses design criteria that have been implemented over the past several years and have been shown to lead toward maintaining, improving or restoring sage-grouse habitat. This interim policy addresses livestock grazing, wildfire, vegetation management, and mineral and energy development. The forest used the best available science when developing this interim policy.

Key Risk Factors

Pinyon-Juniper expansion and conifer encroachment into sagebrush. Pinyon pine has encroached on lower elevation sagebrush ecosystems at a high rate and due to many factors such as wildfire suppression, historic livestock grazing, and changing climate. Jeffery pine encroachment into sagebrush ecosystems is also a concern. The Inyo NF has estimated that almost 41,300 acres of proposed critical habitat has been affected by Jeffery and pinyon pine expansion into sagebrush across over 427,190 acres of proposed critical habitat.

Invasive species and noxious weeds. Invasion of areas by cheatgrass, often following wildfire, affects the fire regime by making areas more flammable, and can reduce sagebrush habitats when fires are too frequent. Over 10,430 aces of cheatgrass are known to occur in proposed critical habitat, most in areas where cheatgrass established following wildfires.

Habitat loss from wildfires: Twelve large wildfires have impacted over 4,000 acres of proposed critical habitat since the year 2000. These fires impacted 35 percent of the priority habitat in the affected population management units.

Predation by ravens. Loss of visual shrub cover for nests has been correlated with increased nest predation by ravens (Coates and Delehanty 2010). Past management practices and weather patterns may be causal to the decrease in understory and shrub cover in sage-grouse habitats.

Human developments. The extent of human development impacting sage-grouse has been limited, with most potential impact occurring with private land development in the Chiatovich Creek area east of the White Mountains in Nevada. Developments can impact sage-grouse use and movement, especially winter range use where roads and housing fragment habitat.

Sierra Nevada bighorn sheep

Species Status on the Inyo NF

Sierra Nevada bighorn sheep historically occupied the high elevations of the Sierra Nevada from Olancha Peak north to Sonora Pass (USDI-USFWS 2007). The recovery plan for this species identified four recovery units: Northern, Central, Southern, and Kern, which are made up of 16 recovery herd units. Portions of the Northern, Central and Southern Recovery Units are located on the Inyo NF and include eleven recovery herd units, ten of which are considered essential. The current population estimate for Sierra Nevada bighorn sheep is about 500 animals located within the ten essential recovery herd units on the Inyo NF. Sierra Nevada bighorn sheep numbers have increased substantially since being listed as an endangered species, when only about 125 animals were documented.

Key Ecological Conditions Needed to Support the Species

Suitable open habitat. Bighorn sheep select open habitats that allow detection of predators at sufficient distances for adequate lead time to reach the safety of steep, generally rocky slopes (USDI - USFWS 2007). Conifer encroachment, especially an increase in pinyon and juniper, facilitated by fire suppression may reduce habitat quality by increasing predator hiding cover.

Winter range: As populations continue to expand, both in number and throughout the recovery area, winter range may become a limiting factor in some herd units. Winter ranges are visually open, but located relatively near escape terrain, and are generally found on south-facing slopes where snow is less likely to occur and there are few trees.

The forest has conducted habitat improvement projects on winter ranges in the Mt. Warren, Mt. Langley and Mt. Williamson herd units.

Key Risk Factors

Disease: Disease transmission by domestic sheep was cited as a threat contributing to the need to list the species (USDI-USFWS 2007). Since listing, the Inyo NF has closed or vacated several sheep grazing allotments within recovery units and uses management strategies and risk assessments based on Baumer et al. 2007 and Croft et al. 2009, to guide management of domestic sheep on the forest.

Pinyon pine expansion in winter range. With the expansion of pinyon-juniper onto south-facing slopes, the amount of suitable winter range has been reduced.

Predation by mountain lions. High rates of predation by mountain lions have been recorded (USDI - USFWS 2007, Stephenson et al. 2012).

Climate change: Climate change may have the potential to affect Sierra Nevada bighorn sheep more directly than other species. The high elevation alpine meadows used in the summer have the potential to become drier as moisture regimes change in the Sierra Nevada. Winter ranges may also be affected if weather patterns lead to less snow pack and more rain. Bighorn sheep may use higher or mid-elevations instead of moving to lower elevations because snowpack would not heed movements at these elevations. However, less snowpack may also affect suitable foraging species on winter ranges, causing green-up to occur earlier which then may reduce the availability of forage later in the spring.

Invertebrates

Federally recognized invertebrates

Common Name	Scientific Name	Status
None		

Plants

Federally recognized plants

Common Name	Scientific Name	Status
Ramshaw abronia	*Abronia alpina*	**Candidate**
Whitebark pine	*Pinus albicaulis*	Candidate

Ramshaw abronia

Species Status on the Inyo NF

Ramshaw abronia occurs as a single large population endemic to Ramshaw and Templeton Meadows in the Golden Trout Wilderness. It has limited suitable habitat and little dispersal ability. This species is restricted to the loose, granitic, sandy soil of meadow margin habitat on the borders of Ramshaw and Templeton Meadows. Occurrence distribution and population appears stable, but total population size fluctuates widely.

Abronia alpina is endemic to the Golden Trout Wilderness, known from one main population center in Ramshaw Meadow, with one sub-population extending into adjacent Templeton Meadow. It is a deeply rooted compact perennial, generally measuring 1-20 centimeter (cm) (0.4-8 inches) in diameter. Total population size has varied widely from year to year, ranging from 54,598 to 130,290 plants (sampling estimates since 1985), with no clear upward or downward trend.

Abronia alpina occurs on arkosic (granitic) gravel meadow margins between the meadows and the lodgepole pine forest and sagebrush scrub communities surrounding them. These soils are fragile, very low in nutrients, porous, and subject to extreme diurnal temperature change.

There is a draft Conservation Agreement for *Abronia alpina*.

Key Ecological Conditions Needed to Support the Species

Open conditions at the edge of occupied meadows. This species is known from very specific locations in loose, granitic, sandy soil along meadow margins.

Key Risk Factors

Climate change. This species is limited to a single population. Changes in precipitation could affect survival of this species. This species has generalist pollinators which may mitigate some risks of changing phenology (timing of blooming) in response to weather.

Conifer encroachment. Lodgepole pine encroachment in meadows may be a concern in reducing suitable in the margins of meadows.

Livestock grazing is not currently a key risk factor because current grazing management has been effective in reducing/eliminating threats to this species.

Climate change. This species is limited to a single population. Changes in precipitation could affect survival of this species. The apparently limited dispersal ability of this species may reduce the potential to migrate to similar habitats in other meadows on the Kern Plateau. This species has generalist pollinators which may mitigate some risks of changing phenology (timing of blooming) in response to weather (Jabis 2009).

Conifer encroachment. Lodgepole pine encroachment in meadows may be a concern in reducing suitable in the margins of meadows.

The population of *Abronia alpina* is within a grazing allotment currently being rested. Trampling effects of grazing recorded in early sampling were reduced to acceptable levels (no subpopulations receiving greater than ten percent damage) by an effective grazing, trailing, and holding strategy implemented from 1995-2000, before the current rest period.

Whitebark pine

Species Status on the Inyo NF

Whitebark pine generally occurs on cold and windy, high-elevation sites, resulting in geographically-isolated stands (Arno et al. 1989). In the Sierra Nevada, stands usually occur at elevations between 10,000 and 12,100 feet. On the Inyo NF, there are approximately 95,000 acres mapped of whitebark pine vegetation types, where whitebark is either the dominant or co-dominant species. The majority of these acres are in wilderness. Whitebark pine is a very long-lived species, with many individuals reaching ages of 1,000 years and older. It is considered a keystone species (disproportionately large effect o the communities in which it occurs) and a major food source for many species of birds and mammals.

Key Ecological Conditions Needed to Support the Species

Subalpine ecosystems. Intact, functioning subalpine ecosystems are required for whitebark pine to persist over the long term.

Key Risk Factors

Climate change. Like other subalpine species, climate change could pose a substantial risk to whitebark pine as there is likely little opportunity for species migration. Whitebark pine can experience high levels of mortality from increased insect (bark beetle) activity that can occur with periodic or sustained droughts. The widespread mortality has been seen in portions of the Rocky Mountains in recent years has not been seen in the Sierra Nevada to date, but the areas remain susceptible to similar widespread mortality.

Fire. Altered fire regime as a result of fire suppression could result in a change in fire intensity or frequency, affecting these long-lived trees.

Insects and disease. The largest threats to whitebark pine in western North America are a combination of white pine blister rust and periodic mountain pine beetle outbreaks (Keane and Parsons 2010, U.S. Fish and Wildlife Service 2011). In some places, successional replacement of whitebark pine as a result of fire suppression has contributed to the species' decline. Climate change has also been directly and indirectly linked to whitebark pine mortality by predisposing trees to insect and pathogen attacks and enabling the geographic expansion of rust and shifts in bark beetles to higher elevations (Millar et al. 2012).

Potential Species of Conservation Concern

Species of Conservation Concern are species known to occur on the Inyo NF that the Regional Forester of the Pacific Southwest Region of the Forest Service determines best available scientific information shows a substantial concern about their capability to persist over the long term in the plan area.

The 2012 Planning Rule draft directives describe the process to identify species of conservation concern. A potential list is identified here based on evaluating the species status rankings from the NatureServe ranking system and other criteria that could indicate a substantial concern as defined in the draft directives. This list will be modified, based on the best available scientific information and public input during the planning process before approval of the LRMP.

Fish, Amphibians and Reptiles

Potential Species of Conservation Concern - fish, amphibians and reptiles

Common Name	Key Ecological Conditions	Key Risk Factors
California golden trout *Oncorhynchus mykiss aquabonita*	Healthy banks with overhanging vegetation	Genetic introgression from rainbow trout Competition with brown trout Excessive livestock impacts and decreased range
Black toad *Anaxyrus exsul*	Associated with ponds, springs, and creeks in and around Deep Springs Valley,	Invasive weeds (Tamarisk) Direct mortality of individuals from road/motor vehicle use
Inyo Mountain salamander *Batrachoseps campi*	Isolated springs in largely desert and desert scrub habitat	Riparian habitat loss (water diversion)
Kern Plateau salamander *Batrachoseps robustus*	Dependent on the discrete microhabitat surrounding springs, seeps, and small	Fire (wildfire) Disruption of riparian habitat

Common Name	Key Ecological Conditions	Key Risk Factors
	streams	
Owens Valley web-toed salamander *Hydromantes platycephalus*	High elevation granite exposures with rock fissures, seepages from streams or melting snow, shade, and low-growing plants, on sheer granite cliffs in the spray zone of waterfalls	High elevation sites likely resistant to significant modification by fire and anthropogenic impacts but low elevation sites may be at risk.
Panamint alligator lizard *Elgaria panamintina*	Riparian areas and washes in the Panamint Range (outside plan area) and surrounding mountains, including the White and Inyo Mountains on the Inyo NF. Boulder and talus slopes, desert scrub, and pinyon-juniper woodland	Invasive species – Salt cedar Off highway vehicle use and mining may be a factor, but the extent is unknown.

Summary of Key Ecological Conditions and Key Risk Factors for Fish, Amphibians, and Reptiles

The key ecological conditions and key risk factors for these potential species of conservation concern center around aquatic or riparian habitats, even for the terrestrial species. For the one truly aquatic species, California golden trout, the key risk factor is related to sufficient water quantity in occupied streams. The other species are dependent on ponds, springs, seeps, streams or creeks and associated riparian habitats. Severe wildfire and trends in climate change generally have a negative influence on water quantity and quality, and can change the distribution of these limited aquatic and riparian habitats. In addition, they can change where suitable habitats for these species exist on the forest. Large changes in habitat can occur due to large areas burned by moderate or high severity fire, or by warming and drying conditions associated with climate change. Low and moderate severity fire effects likely benefit these species by improving vegetation condition and diversity without significantly affecting logs and riparian habitat. Changes can also occur at the local scale such as streambank impacts from livestock, recreation activities, roads, or trails, which can be important for these species with limited populations or limited habitat. For the more terrestrial salamander species and the Panamint alligator lizard, ground-based disturbance from a variety of sources could directly impact individuals on the surface or under rocks, logs or forest litter. As these species tend to be fairly localized, trends can only be evaluated in the context of known habitats and suitable habitat or specific habitat areas.

Birds and Mammals

Potential Species of Conservation Concern - birds and mammals

Common Name	Key Ecological Conditions	Key Risk Factors
Desert bighorn sheep *Ovis canadensis nelsoni*	Open terrain with steep, rocky slopes	Disease (domestic sheep and goats) Loss of open habitat Predation (mountain lions)
American marten *Martes americana*	Mature conifer forests with high overhead cover Abundant snags and down	Habitat loss, including loss of understory cover Habitat fragmentation (large

Common Name	Key Ecological Conditions	Key Risk Factors
	logs Heterogeneous habitat to support prey species.	wildfires; ski area expansion) Roads (mortality and predator access)
Long-eared myotis *Myotis evotis*	Hibernation sites (mines and buildings) Roost sites (caves, mines, buildings, crevices, snags) Open water surfaces	Hibernation disturbance Loss of snags Roost disturbance
Western small-footed myotis *Myotis ciliolabrum*	Deserts, chaparral, riparian zones, and western coniferous forest; especially pinyon-juniper forest Hibernation sites (caves) Roost sites (caves, mines, crevices, snags)	Hibernation disturbance Loss of snags Roost disturbance
Townsend's big-eared bat *Corynorhinus townsendii*	Caves and mines	Roost disturbance (recreation and mining) Pesticides
Pallid bat *Antrozous pallidus*	Mountainous areas and near water 3 different roost sites Open areas for foraging	Roost disturbance (recreation) Pesticides Loss of roost trees and snags
Spotted bat *Euderma maculatum*	Roost sites (cliffs, outcrops, talus slopes, buildings) Forest – Riparian interface	Roost disturbance (recreation and mining) Pesticides
Northern goshawk *Accipiter gentilis*	Diverse forest habitats for prey Structurally diverse forests for nesting Snags (for prey habitat)	Fire (loss of nesting habitat) Habitat loss (timber harvest, fire, drought related tree mortality)
Willow flycatcher *Empidonax traillii*	Wet meadows with woody riparian shrubs Standing water in meadows	Meadow drying (roads, historic impacts, water diversions) Nest disturbance (predators and nest parasitism)

Summary of Key Ecological Conditions and Key Risk Factors for Birds and Mammals

The key ecological conditions for these species and the key risk factors affecting those conditions can be generally described as:

- Cliffs, caves, buildings and mines (long-eared myotis, western small-footed myotis, Townsend's big-eared bat, Pallid bat and spotted bat)
    - Risk of recreation-related disturbance to bats
    - Risk of mining-related disturbance.
- Meadows and riparian habitat (willow flycatcher)
    - Loss of riparian habitat due to changes in water levels or diversion.
- Alpine and subalpine habitats (Desert bighorn sheep)

- Temperate and habitat change related to climate change. Species dependent on seeps and springs in high elevation areas which are susceptible to climate change.

- Structurally diverse mature forests (American marten and northern goshawk)

  - Risk of loss of habitat and habitat fragmentation of conifer forest from wildfire outside the natural range of variability. While the current trends do not show a significant increase in the extent of forest change from wildfire on the Inyo NF, substantial areas are at a low and very low fire resiliency index as described in Chapter 3 of this assessment, indicating they are susceptible to higher amounts of crown fire than expected.

- Large trees and snags (northern goshawk, American marten)

  - Risk of inadequate number, distribution, and quality of large living trees and dead trees (snags) of sufficient density, size, area and age to support key life history needs of species. Due to fire suppression, there may be fewer total patches of snags created from fire across the landscape. However, some fire-created patches of snags are exceedingly large and are created from burning older forests which competes with the habitat need for other at-risk species that need large living trees such as the northern goshawk and American marten.

Additionally some risk factors are not directly associated with a key ecological condition. For example, primary roads are a source of direct mortality to some species such as marten.

Invertebrates

Potential Species of Conservation Concern - invertebrates

Common Name	Key Ecological Conditions	Key Risk Factors
Owens Valley springsnail *Pyrgulopsis owensensis*	Undisturbed spring-fed small to medium streams	Water quality (temperature) Climate change Water quantity
Wong's springsnail *Pyrgulopsis wongi*	Undisturbed spring-fed small to medium streams	Water quality (temperature) Climate change Water quantity
Tehachapi fritillary *Speyeria egleis tehachapina*	Host plants on mountain summits and peaks, including Viola purpurea xerophyte and other related species of violets	Fire (effects on host plants, short and long term) Climate change
San Emidgio blue *Plebulina emigdionis*	Host plant, *Atriplex canescens* Dry river beds and intermittent streams and adjacent flats	Climate change Development Wildfire

Summary of Key Ecological Conditions and Key Risk Factors for Invertebrates

Springsnails require undisturbed springs. Even small water developments or disturbances can limit the ability of these species to use the area. The butterflies are limited to areas with suitable host plants and other, often unknown factors. The San Emidgio blue is known to be limited by other factors since it doesn't occur in some areas, even if the host plant is present. Climate change is a substantial risk factor for these species because they have very limited distributions. Springsnails are dependent on seeps and springs which can be affected by changed precipitation patterns. The butterflies can be affected by changed seasonality of rain and temperature that might cause a shift in the survival or flowering season of host plants.

Plants

Potential Species of Conservation Concern – plants

Common Name	Scientific Name	Key Risk Factors (Drivers / Stressors)	Positive Factors	Assessment Type
Inflated Cima milk-vetch	*Astragalus cimae var. sufflatus*	Only 7 populations, grows on carbonate soil.	Able to grow in roads, may be well-adapted to disturbance. Some on National Park Service land.	Sagebrush shrub / pinyon-juniper
Inyo milk-vetch	*Astragalus inyoensis*	Annual invasives present in at least 9 INF populations. Roads bisect several populations. Carbonate or volcanic soils.	Likely more widely distributed than currently mapped.	Sagebrush shrub / pinyon-juniper
Long Valley milk-vetch	*Astragalus johannis-howellii*	Grazing, roads, mining, and geothermal development may impact. Volcanic soils with prior hot springs.)	27 total populations, many in Nevada.	Sagebrush shrub
Lemmon's milk-vetch	*Astragalus lemmonii*	Grazing, roads, fish hatchery operations. Alkali flat may be vulnerable to climate change.	Wide range (7 CA counties, NV, OR)	Alkali flat
Kern Plateau milk-vetch	*Astragalus lentiginosus var. kernensis*	Grazing, roads. Mostly Kern Plateau endemic (1 exception).	36+ populations with >10,000 individuals, about half in wilderness.	Sagebrush shrub
Mono milk-vetch	*Astragalus monoensis*	Pumice sand flat habitat, roads. Unauthorized OHV use. Limited range (Mono Co. endemic). Cheatgrass reported from 4	Tolerant of some disturbance, sheep bedding restrictions on sand flats.	Dry forb community

Common Name	Scientific Name	Key Risk Factors (Drivers / Stressors)	Positive Factors	Assessment Type
		populations.		
Raven's milk-vetch	*Astragalus ravenii*	Climate change (high elevation), only 3 populations known	Populations in wilderness.	Subalpine conifer / alpine
Kern County milk-vetch	*Astragalus subvestitus*	Grazing, roads.	More populations recently found south of INF. Apparently tolerates some impacts.	Sagebrush shrub
Bodie Hills rockcress	*Boechera bodiensis*	Mineral development, roads, grazing (sheep).	33+ occurrences, abundant unsurveyed potential habitat.	Sagebrush shrub/ pinyon-juniper
Pinzl's rockcress	*Boechera pinzliae*	Climate change (high elevation). Hiking trails. 4 pops with annual invasive grasses.	All populations on the Inyo NF in wilderness.	Subalpine conifer/ alpine
Shockley's rockcress	*Boechera shockleyi*	Loss of habitat due to mining on San Bernardino NF. Roads, trails, climate change (carbonate or quartzite soils).	95+ occurrences, 3 state range.	Pinyon-juniper/ xeric shrub
Tiehm's rockcress	*Boechera tiehmii*	Climate change (high elevation), trails.	9 INF populations in wilderness	Subalpine conifer/ alpine
Tulare rockcress	*Boechera tularensis*	Possibly grazing, hydrologic changes	INF populations in wilderness	Subalpine conifer/riparian (meadow)
Upswept moonwort	*Botrychium ascendens*	Hydrologic changes from climate change, grazing, trails.	3 INF populations in wilderness, wide distribution (western states)	Riparian
Scalloped moonwort	*Botrychium crenulatum*	Hydrologic changes from climate change, grazing, trails.	4 INF populations in wilderness, wide distribution (western states)	Riparian
Slender moonwort	*Botrychium lineare*	Hydrologic changes from climate change, grazing, trails.	INF population in wilderness, wide distribution (western states)	Riparian
Inyo County star-tulip	*Calochortus excavatus*	Groundwater pumping in Owens Valley, grazing, invasive species, Alkali flat	68 known occurrences. Pasture use restrictions in place (McMurray Mdw.)	Alkali flat
Pygmy pussypaws	*Calyptridium pygmaeum*	Trails, recreational impacts. Climate change (high elevation).	2 INF populations in wilderness.	Subalpine conifer

Common Name	Scientific Name	Key Risk Factors (Drivers / Stressors)	Positive Factors	Assessment Type
Idaho sedge	*Carex idahoa*	Climate change (high elevation), grazing.	Wide range (10 western states)	Riparian /subalpine conifer
Tioga Pass sedge	*Carex tiogana*	Climate change (high elevation), trails, hiking.	All 3 INF populations are in wilderness.	Riparian/ subalpine conifer
Kern Plateau bird's-beak	*Cordylanthus eremicus ssp. kernensis*	Roads, trails, grazing.	3 INF populations in wilderness.	Sagebrush shrub/sub-alpine conifer
Hall's meadow hawksbeard	*Crepis runcinata ssp. hallii*	Grazing, OHV use. Alkali flat.	Relatively wide range in CA.	Alkali flat
Rosette cushion cryptantha	*Cryptantha circumscissa var. rosulata*	Hiking, climate change (high elevation).	26 populations in CA. Not tracked in NV.	Alpine/ subalpine conifer
Bristlecone cryptantha	*Cryptantha roosiorum*	Carbonate soils, limited range, grazing.	Majority of populations outside of grazing allotments.	Subalpine conifer
July gold	*Dedeckera eurekensis*	Low regeneration capability, carbonate soils, annual weeds present in 6 populations, mining.	29 populations, high genetic diversity, steep rocky habitat with few direct impacts from activities.	Pinyon-juniper/ xeric shrub
California draba	*Draba californica*	Climate change (high elevation, meadow), grazing, roads, research station	At least 4 populations in wilderness	Alpine/ sagebrush
White Mountains draba	*Draba monoensis*	Climate change (high elevation), trails, grazing.	2 INF populations in wilderness.	Subalpine conifer/ meadow
Mount Whitney draba	*Draba sharsmithii*	Climate change (high elevation), trails including high traffic Mt. Whitney Trail.	All INF populations in wilderness.	Alpine/ subalpine conifer
Gilman's goldenbush	*Ericameria gilmanii*	Mining, roads, hiking, camping, annual invasive species.	Access road to INF population is not authorized for use.	Pinyon-juniper
Compact daisy	*Erigeron compactus*	Observatory, roads, annual invasive species, some on carbonate soils.	Populations avoided during construction of observatory. Wide range (4 states).	Pinyon-juniper/ xeric shrub
Olancha Peak buckwheat	*Eriogonum wrightii var.*	Climate change (high elevation),	Both populations in wilderness. Estimated	Alpine/ subalpine conifer

Common Name	Scientific Name	Key Risk Factors (Drivers / Stressors)	Positive Factors	Assessment Type
	olanchense	only 2 occurrences, re-introduced endangered bighorn.	3600+ individuals in 2011.	
Limestone monkey-flower	*Erythranthe calcicola*	Climate change (limestone soil), invasive species	Access road to 1 INF population not authorized for use.	Pinyon-juniper /xeric shrub
Golden goodmania	*Goodmania luteola*	Grazing, possibly ground-water pumping in Owens Valley, invasive plants. Extirpated from part of its range (San Joaquin Valley).	Approximately 80 populations extant.	Alkali flat
Beautiful cholla	*Grusonia pulchella*	Grazing. Possibly plant collection.	Not tracked by Nevada. Inconspicuous when not blooming.	Sagebrush shrub, xeric shrub
Poison Canyon stickseed	*Hackelia brevicula*	Grazing, possibly climate change (high elevation).	Some populations in wilderness.	Riparian
Blandow's bog moss	*Helodium blandowii*	Grazing, hydrologic alteration.	1 INF population in wilderness, others in NP.	Riparian
Jaeger's hesperidan-thus	*Hesperidanthus jaegeri*	Mining, goats (BLM land). Limestone soils.	Access to INF population is road unauthorized for use.	Pinyon-juniper
White Mountains horkelia	*Horkelia hispidula*	Development, roads, grazing.	Tolerant of some road disturbance, extensive unsurveyed potential habitat.	Sagebrush shrub / subalpine conifer
Short-leaved hulsea	*Hulsea brevifolia*	Erosion, grading, grazing, logging, trampling, OHV use.	63 populations, disturbance (fire) follower, 1 INF population in wilderness.	Red fir
Inyo hulsea	*Hulsea vestita ssp. inyoensis*	Mining, erosion, invasive annual grasses present at 1 INF population.	1 INF population in wilderness, steep talus habitat.	Pinyon- juniper / xeric shrub
Field Ivesia	*Ivesia campestris*	Grazing, foot traffic, recreational uses.	May be tolerant of some hydrologic alteration, recently changed from CNPS list 1B to list 4 (less concern about viability status) because of abundance.	Meadow, subalpine conifer
Mono Lake lupine	*Lupinus duranii*	Pumice sand flat habitat1, roads. Unauthorized OHV use is common. Limited range	Large # of individuals. Tolerant of some disturbance, sheep bedding restrictions on sand flats.	Dry forb community

Common Name	Scientific Name	Key Risk Factors (Drivers / Stressors)	Positive Factors	Assessment Type
		(Mono Co. endemic). Annual invasive reported from 1 population.		
Father Crowley's lupine	*Lupinus padre-crowleyi*	Grazing, invasive annual species, roads, recreational development.	Responds well to fire, may be disturbance dependent? 3 INF populations in wilderness	Jeffrey pine/ subalpine conifer
Inyo blazing star	*Mentzelia inyoensis*	No threats listed in CNDDB. Possibly mining? 8 populations	Talus habitat not affected by most recreational activities.	Sagebrush shrub/ pinyon-juniper
Torrey's blazing star	*Mentzelia torreyi*	Annual invasives, mining. Alkaline habitat.	Relatively wide range (CA, OR, ID)	Sagebrush shrub/ pinyon-juniper
Sweet-smelling monardella	*Monardella beneolens*	Climate change (high elevation), trails, grazing. 2 INF populations are hybrids, so # of populations has decreased. Bighorn sheep translocation needs monitoring.	INF populations are in wilderness.	Subalpine conifer
Blue pendent-pod oxytrope	*Oxytropis deflexa var. sericea*	Grazing, possibly climate change (high elevation).	Wide range (11 states), 5 INF populations in wilderness.	Riparian
Inyo phacelia	*Phacelia inyoensis*	Grazing, trampling, OHV use	Grazing timing can be managed to reduce impacts.	Alkali flat
Mono County phacelia	*Phacelia monoensis*	Rhyolite clay soils, grazing, road maintenance, mining, vehicles, invasive annuals.	Adapted to roadside disturbance, fairly large range (NV).	Pinyon-juniper/ sagebrush shrub
Parish's popcorn-flower	*Plagiobothrys parishii*	Hydrologic alteration, invasive species, grazing, OHV use, 2 locations (off-INF) reported extirpated.	INF population is in a location that is difficult to access.	Sagebrush shrub
Mason's sky pilot	*Polemonium chartaceum*	Species recently split, reducing # of populations, climate change (high elevation).	All INF populations are in wilderness, monitoring in 2011 showed increase in number (White Mtn. pop)	Alpine, sagebrush shrub
Williams' combleaf	*Polyctenium fremontii (P. williamsiae)*	Wild horse use, grazing, recreational uses. Climate change may cause reduction in habitat	Relatively large range (CA, NV, OR). Unsurveyed potential habitat.	Riparian (vernally wet)

Common Name	Scientific Name	Key Risk Factors (Drivers / Stressors)	Positive Factors	Assessment Type
		(rainfall/seasonality).		
Narrow-leaved cottonwood	*Populus angustifolia*	Only CA site, water facilities/diversions.	Resprouting observed after fire, common in Rocky Mountains.	Riparian
Morefield's cinquefoil	*Potentilla morefieldii*	Climate change (high elevation), grazing, roads/trails, development.	Extensive unsurveyed habitat, 9 INF populations in wilderness.	Sagebrush shrub, subalpine conifer
Beautiful cinquefoil	*Potentilla pulcherrima*	Climate change (high elevation), grazing.	Wide range (14 states), INF population in wilderness.	Riparian
Frog's-bit buttercup	*Ranunculus hydrocharoides*	Grazing, channel clearing	Wide range (western hemisphere)	Riparian
Mojave fish-hook cactus	*Sclerocactus polyancistrus*	Plant collectors, roads, limestone.	~47 populations (CA, NV), difficult to locate unless blooming.	Pinyon-juniper/ xeric shrubs
Alkali tansy-sage	*Sphaeromeria potentilloides var. nitrophila*	Grazing, vehicles.	Relatively wide range (CA, NV, ID)	Alkali flat
Masonic Mountain jewel-flower	*Streptanthus oliganthus*	Mining, roads, development (Marine base, aqueducts)	~36 populations, probably extensive unsurveyed habitat.	Pinyon-juniper/ subalpine conifer
Slender townsendia	*Townsendia leptotes*	Climate change (high elevation), 3 in grazing allot.	Occurs in 8 other states, all on INF are in wilderness	Alpine/ sagebrush
Little bulrush	*Trichophorum pumilum*	Climate change (high elevation, wet limestone areas)	Also occurs in northern Rocky Mountain states.	Special (meadow)/ subalpine conifer/ sagebrush shrub
DeDecker's clover	*Trifolium kingii ssp. dedeckerae*	Climate change (high elevation), endangered bighorn sheep, trails, grazing, roads.	Extensive unsurveyed potential habitat, 7 INF populations in wilderness.	Subalpine conifer
Marsh arrow-grass	*Triglochin palustris*	Climate change (high elevation), trails.	Wide range (western hemisphere).	Riparian
Golden violet	*Viola purpurea ssp. aurea*	Roads, development (powerline), invasive species.	Extensive unsurveyed potential habitat.	Pinyon-juniper/ sagebrush shrub

The information in this table is based on information from the California Natural Diversity Database, the Consortium of California Herbaria, the California Native Plant Society Inventory of Rare and Endangered Plants, and Inyo NF records.

Summary of Key Ecological Conditions and Key Risk Factors for Plants

Climate change is identified as a key risk factor for many species, primarily those occupying high elevation, alpine and subalpine areas as well as those dependent on seeps, springs and other wet areas. Alkaline and limestone soils are important for some species. Plants face a unique challenge in that populations can be fragmented by localized impacts, thus, several species indicate that roads bisecting populations is a risk factor. Recreation trails are also identified as a risk factor both as a means to bisect populations but also for direct impacts to individual plants. The more limited ability of plants to disperse also makes it more uncertain how species that depend on specific soils can react to climate change if temperature or precipitation patterns change such that the ideal conditions move upslope where there are not suitable soils. Fire is not directly identified as a risk for most plant species, although for those dependent on or affected by pinyon-juniper or sagebrush, the implications of fire as a driver greatly affects the distribution and composition of those vegetation types. Livestock grazing is listed as a key risk factor for many species. However, due to the limited distributions for most of these plant species, the specific risks cannot be addressed in this coarse assessment as the risks would depend on the timing and how it grows, when it blooms, when it sets seed, along with the timing and extent of livestock grazing at those sites.

Overall Summary of Key Ecological Conditions and Key Risk Factors

Climate change is a key risk factor that applies either directly or indirectly to all at-risk species. A summary of current conditions and trends related to climate change is provided in Chapter 3 of this assessment. These species are identified as at-risk due to low population size, low amounts of suitable habitat, or substantial threats to populations or habitats. The projected changes in both habitats and ecological processes that may result from climate change could have a disproportionate impact on at-risk species as they may be less able to respond to changed conditions or be robust enough to recover from abrupt climate-related changes. For example, small localized populations or limited habitat could be effectively eliminated by a single large wildfire event with little opportunity for re-colonization from adjacent areas over time as habitats recover.

For aquatic species, changes in types and patterns of precipitation, particularly rain and snowfall patterns, could alter key life cycle sequences. For example, the mountain yellow-legged frog is strongly tied to deep water in high elevation lakes for breeding during a short breeding season. If patterns of snowfall change or lake freeze and thaw patterns change, the timing of winter hibernation will change. This could expose frogs to predators for longer periods. Climate change could alter any of these important conditions, resulting in lowered breeding success or increased mortality. As each species has a unique set of environmental relationships, this assessment defers to the more detailed species accounts when detailed life history and threat information is needed to support developing and evaluating potential plan components.

Fire is another key risk factor that applies to many at-risk species and current conditions and trends are described in Chapter 3 of this assessment. Habitats for at-risk species in the large area of the Inyo NF at low to mid-elevations where fires have burned less frequently than historically that also have low or very

low wildland fire resilience have a higher potential to be negatively affected by future large wildfires. See Chapter 3 of this assessment for more detail on this subject. The implications of this habitat change from wildfires depends on: 1) the specific habitat types used or required by each species; 2) the amount and extent of remaining suitable habitat in burned areas; and 3) how quickly suitable habitat and other necessary conditions recover. Wildfires that burn large areas of structurally diverse older forests at moderate and high severity generally reduce high quality breeding habitat for species such as northern goshawk and marten over the long term,.

Livestock grazing is a key risk factor for many aquatic species, several plant species and a few vertebrate species, especially those associated with meadows, riparian areas and springs. Current livestock numbers on the Inyo NF are approximately 60 percent of those permitted in the 1960s. Conditions in meadows and riparian areas have generally been improving and most measures of rangeland condition indicate an upward trend. See Chapter 1 and Chapter 8- Range of this assessment for additional information about meadow and riparian conditions and trends. Regardless of these general conditions and trends, conditions and trends for each species should be evaluated in the context that several at-risk species have limited ranges or specific habitat requirements and low population numbers. This level of detail is not readily available for consideration in this assessment, but will be considered, as appropriate, during later plan revision phases.

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

The presence of at-risk species in the plan area affects management decisions. For federally listed species, projects are generally designed to maintain or enhance habitat and to avoid or mitigate potential effects to individuals in order to comply with the Endangered Species Act. This can increase the time and cost for project planning if species inventory is needed, or if additional work is needed to assess habitat conditions before making a project decision. In addition, procedures to ensure appropriate regulatory oversight by the U.S. Fish and Wildlife Service are factored into project level planning when federally listed species could be affected. This can impact the rate and pace for designing and implementing projects aimed at ecological restoration.

However, specific funding exists for projects designed to enhance at-risk species habitat or reduce threats to at-risk species, and often projects with an objective to benefit at-risk species are given a priority for funding or emphasis. Partnerships with other agencies and stakeholder groups are often focused on benefitting at-risk species. This can increase support for projects aimed at ecological restoration that reduce threats for at-risk species. Implementation of habitat improvement projects designed to benefit at-risk species can contribute to the local labor force and economy when work is accomplished through contractors.

The presence of some charismatic at-risk species, such as bighorn sheep, contributes to the recreational activity of viewing nature, which contributes to the local recreation economy. Data from the National Visitor Use Monitoring (NVUM) program for 2007 showed that viewing wildlife was a popular reported recreation activity on the Inyo NF at 34.6 percent. Often the presence of these highlighted species increases the appeal of an area for nature watchers, even if they do not specifically seek these species out.

Management for at-risk species can be used as an indicator of sustainability of forests related to the conservation of biological diversity. The trends in the species diversity indicators are provided in Chapter 1 of this assessment.

Information Gaps

Systematic inventories to document the contemporary presence or absence of most at-risk species do not exist. Historic distribution and historic population estimates are not known for most species, although more data generally exists for federally listed species. General accounts from the last 100 years from naturalists, and studies from recent decades allow extrapolation of abundance and distribution. This information gap must be considered in the context of the current and admittedly altered, drivers and stressors. In many cases, due to human encroachment into the wildlands, the permanent or semi-permanent alteration of habitats due to land use changes, and the fundamental alteration of drivers and stressors such as fire, restoration to historic species distributions and population levels cannot be realistically attained.

Similarly, key life history information is lacking or has not been synthesized into a readily available format for some species. Additional information will be sought for inclusion in the final assessment and throughout the planning process, as needed.

For most amphibian species, a variety of fungal pathogens as a disease agent are a significant concern for population sustainability. These diseases are the focus of many recent and ongoing research efforts. As research information accrues and causal relationships are established, the significance of disease as a key factor can better be evaluated.

The direct and indirect cause-and-effect relationships between effects of disturbance to individuals and from changes in habitats that may cause either positive or negative changes in survival, mortality, and breeding rates does not exist for most species.

Chapter 6 Assessing Social, Cultural and Economic Conditions

The 2012 Planning Rule for National Forest System (NFS) land management planning recognizes that social, economic, and ecological systems are interdependent and as such, the planning rule requires the consideration of social, economic, and ecological factors in all phases of the planning process. National forest management can influence social and economic conditions relevant to a planning area, but cannot ensure social and economic sustainability, because many factors are outside the control and authority of the responsible official. For that reason, the 2012 Planning Rule requires that plan components contribute to social and economic sustainability within Forest Service authority, and the inherent capability of the plan area. To accomplish this goal, it is necessary to understand the context of socioeconomic conditions for the Inyo NF. This chapter provides a summary of this context, as well as references to the more detailed socioeconomic information available in the September 2, 2013 snapshot of the Inyo NF Living Assessment Chapter 6.

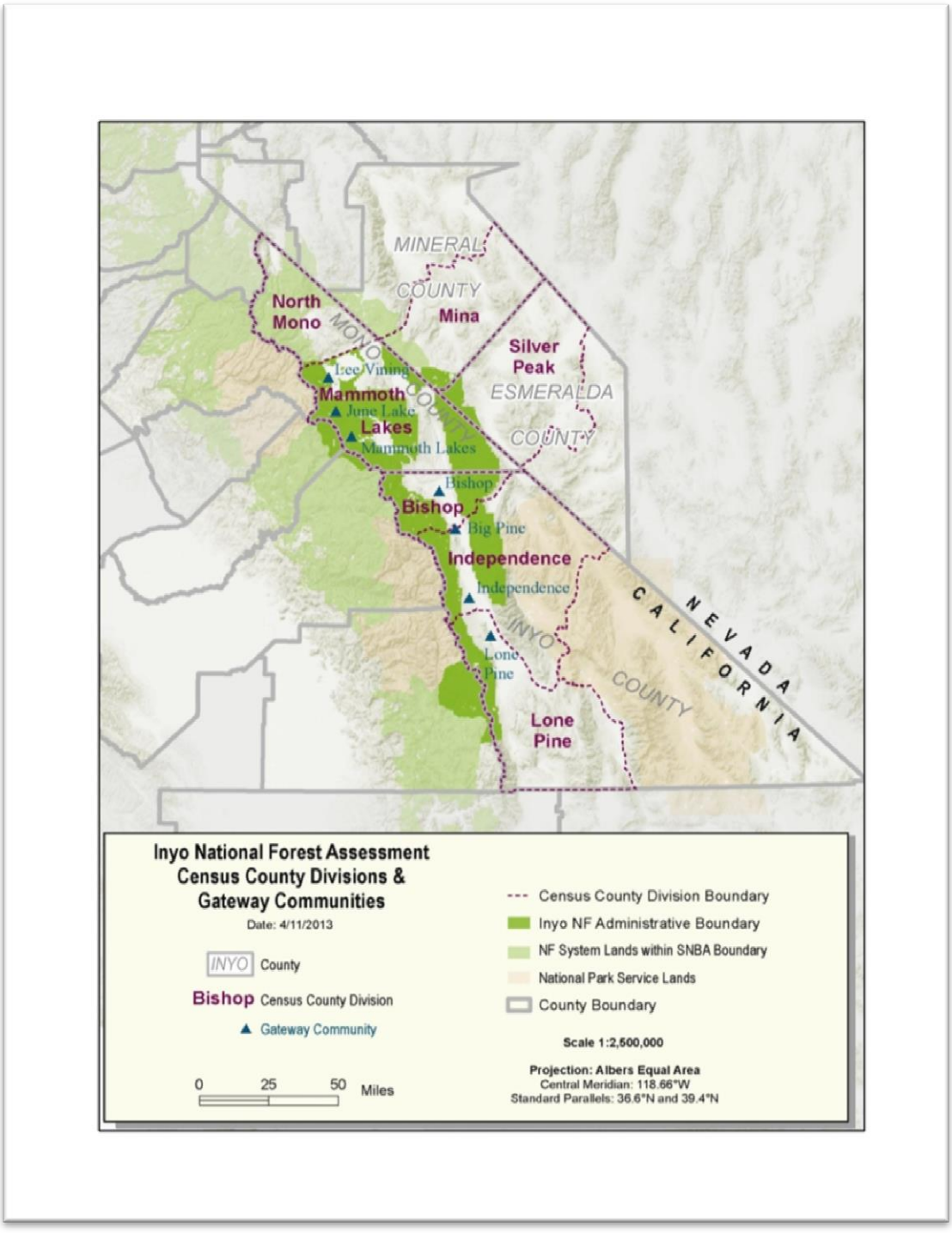
Important Information Evaluated in this Phase

This chapter is a summary of the information provided in the Inyo NF Chapter 6 topic paper on socioeconomics. The focus is on assessing social, cultural, and economic conditions in the Inyo NF's area of influence. However, conditions outside of the area of influence can also impact the Inyo NF and

conversely, management decisions on the forest can have impacts far beyond the plan area. Therefore, a layering of these scales will be considered and incorporated throughout the chapter where applicable and will provide a more complete picture of the socioeconomic conditions in the Inyo NF's area of influence. Conditions in the area of influence will be compared to conditions in the Sierra Nevada bio-region, in California and in the nation as a whole.

This chapter presents socioeconomic data for the Inyo NF's area of influence, defined here as the seven census county divisions (CCDs) from the four counties that intersect the forest administrative boundary, Inyo, Mono, Esmeralda and Mineral Counties. These counties also have large portions of land area that lie outside of the plan area. Using data for these CCDs rather than for all the counties provides a closer fit to the geographical footprint of the plan area. However, data is also presented for the counties as a whole to allow for a comparison of county conditions to the more local forest conditions. In some cases, such as with the economic portions of this chapter, CCD-level data are not available for many variables and therefore only county-level data is presented.

The map below shows the Inyo NF plan area and its relationship to the surrounding counties. The forest comprises portions of the areas of Inyo, Mono, Esmeralda and Mineral Counties. In addition, the figure shows key communities that are adjacent to the forest including Lee Vining, June Lake, Mammoth Lakes, Bishop, Big Pine, Independence, and Lone Pine.



Inyo NF Assessment Census County Divisions and Gateway Communities

In addition to CCD and county-level information, socioeconomic data for gateway communities in the area of influence is presented. Gateway communities are communities that exist in close proximity to the Inyo NF whose residents and elected officials are often affected by the decisions made in the course of managing the forest, and whose decisions may affect the resources of the forest. Because of this, there are shared interests and concerns regarding decisions. These gateway communities also typically offer food, lodging, and other services to forest visitors, provide opportunities for employee housing, and a convenient location to purchase goods and services essential to forest administration (definition adapted from the National Park Service) (National Park Service 2006).

A primary source of socioeconomic data for the area of influence, including population, age, gender, race, ethnicity, language, education, housing, poverty levels, household earnings, and employment were taken from the Economic Profile System – Human Dimension Toolkit (EPS-HDT) developed by Headwaters Economics in partnership with the Bureau of Land Management and the Forest Service. Another important source of information was the "Science Synthesis to Support Land and Resource Management Plan Revision in the Sierra Nevada and Southern Cascades," developed by the USDA Forest Service Pacific Southwest Research Station (Long et al. 2013).

Nature, Extent and Role of Existing Conditions and Future Trends

This section summarizes: (1) the social, cultural, and economic context of existing conditions and future trends for the Inyo NF; and (2) the social, cultural, and economic conditions that are influenced by forest management.

Social, Cultural, and Economic Context of the Inyo NF

The focus of this section is to provide the social, cultural, and economic context of existing conditions and future trends for the Inyo NF. This context is important because it influences national forests and forest management. Thus, while forest management can, to an extent, influence social, cultural, and economic conditions, larger socioeconomic forces may be at play that influence the agency's management decisions and outcomes and, thereby, its ability to influence some of these conditions.

Historical context

See Chapter 13 of this assessment for a description of the Inyo NF's historical context.

Cultural context

The current cultural conditions in the Sierra Nevada in general are deeply tied to the region's rich past and can influence how National Forest System (NFS) lands in the bio-region are used and managed. In 2010, the Native American population accounted for 7.8 percent of the total population in the Inyo NF's area of influence, which is greater than the percentage of Native Americans in the total population at bio-regional, state, and national levels. The Native American population in the area of influence accounted for 5.6 percent of the total Native American population in the Sierra Nevada bio-region. Fifty-five percent of the Native American population in the area of influence is located in the Bishop CCD in Inyo County and 23 percent is located in the Mammoth Lakes CCD in Mono County.

Timber harvesting is also a part of the bio-region's cultural heritage and has played a lasting role in shaping community values and identities. These timber communities have a strong sense of place and

value close community ties, community self-reliance, and individualism (Kusel 1996). The Inyo NF is the primary source for fuelwood for home heating in the eastern Sierra region south of Conway Summit because of the abundant supply and relative ease of access.

Mining has played a major role in shaping the history and culture of the Sierra Nevada in general and this is true for the Inyo NF as well. As described in Chapter 10 of this assessment, active mining claims are present on the Inyo NF and are expected to continue based on the number of existing mining claims that have been maintained for decades and the regular filing of new claims. The long history of mining is evident by the presence of an estimated 1,500 abandoned mines on the forest and over 5,000 on the broader landscape.

Ranching and agricultural lands are an integral part of the region's economy, history, cultural heritage and scenic beauty (Sierra Nevada Conservancy 2011a and 2011b). Ranchers continue to depend on public land grazing to support their livelihood. There are a total of 49 cattle and horse and sheep and goat allotments currently identified on the forest. Records for 2012 report 4,717 head of cattle and 15,350 head of sheep were permitted to graze at various times throughout the year. Interviews conducted with ranchers in the central Sierra Nevada foothills, revealed that for the majority of ranchers "living and working amidst natural beauty was a highly important reason to continue ranching" and "although ranching is not seen as the ideal way to make a living, most ranchers want their children to continue ranching and to pass on the family tradition" (Sulak and Huntsinger 2002 p.4).

Outdoor recreation is a large part of the culture and lifestyle in the Sierra Nevada and one of the main ways that residents and visitors connect to the land and enjoy the natural world. Recreation plays a significant role in contributing to tourism in the region, which relies on the condition of Sierra Nevada ecosystems (Duane 1996). According to National Visitor Use Monitoring (NVUM) data from fiscal years 2005-2007, annual visitation to the Inyo NF was estimated to be 2.86 million people. Of the ten national forests in the bio-region, the Inyo NF is the second most visited forest, after the Lake Tahoe Basin Management Unit. According to 2011 NVUM data, visitation decreased to 2.52 million people. Key visitor activities on the forest are: viewing natural features, relaxing, downhill skiing, hiking/walking, viewing wildlife and driving for pleasure. Also, many visitors to the Inyo NF come from outside the area of influence. Data for 2011 shows that about 15 percent of visitors traveled fewer than 100 miles, and about 85 percent traveled more than 100 miles.

Population

According to the Sierra Business Council (2007), population growth is considered to be the driving force of change throughout the Sierra Nevada. The population in the Inyo NF area of influence grew by 5.3 percent between 2000 and 2010 to 32,620 people. This is much less than the 14.6 percent increase that occurred at the bio-regional level, and less than the approximately eight percent increase that occurred at both state and national levels during this same time period. Within the area of influence, the largest percentage growth in population (15.7 percent) occurred in the Lone Pine CCD of Inyo County. Note that many CCD's in the area of influence experienced decreases in population including Mina (minus 62.3 percent), North Mono (minus 19.3 percent) and Independence (minus 11.3 percent). In general, not much local population growth is possible due to large amounts of land under public ownership. By 2050, the population is expected to increase 37 percent in Mono County and 27 percent in Inyo County, which is much less than the 69 percent for the counties of the bio-region (California Department of Finance 2012a).

Demographics

The age distribution in the area of influence is shifted toward older age classes and is less racially and ethnically diverse than the Sierra Nevada bio-region as a whole. In 2010, 21 percent of people in the assessment area identified as Hispanic or Latino (of any race), compared to 29 percent in the bio-region, 37 percent in the state, and 16 percent of people in the nation as a whole. While the forest's assessment area also has less racial diversity than at other scales, the one exception is the Native American population, which has a higher representation in the population as whole (eight percent) compared to the bio-region, state, and county (one percent). The Native American population in the Bishop CCD alone accounted for over half of this Native American population.

Settlement Patterns and Housing

Settlement and housing patterns are greatly influenced by land ownership in the assessment area. In Mono and Inyo Counties combined, the City of Los Angeles owns over 300,000 acres, about 250,000 in Inyo County and 60,000 in Mono County. About 75 percent of that land is open to the public for recreational uses (LADWP 2010), and most of the rest is leased by ranchers. About two percent of Inyo County, and six percent of Mono County is in private land ownership and available for development. Most of the remaining land is federally-managed, either by the Forest Service or Bureau of Land Management. Typically, the valley bottoms are owned by Los Angeles, Bureau of Land Management land is in the foothills, and the higher elevation areas are National Forest System lands. See Chapter 14 of this assessment for more information about land ownership patterns.

Human Wellbeing

Poverty rates in the Inyo NF assessment area are lower than the bio-region as a whole. In 2010, the poverty rate in the assessment area was about 12 percent for individuals and two percent for families, which compares to 17 and 12 percent, respectively, in the bio-region. The Mina and Lone Pine CCDs have the highest poverty rates in the assessment area.

About 88 percent of people in the assessment area have a high school degree, which is higher than bio-regional (82 percent), state (81 percent), and national (85 percent) levels. The Mina and Silver Peak CCDs have the largest percentage of people over 25 years of age who do not have a high school degree.

According to the University of Wisconsin Population Health Institute's County Health Rankings (2013), Inyo and Mineral counties are two of the lowest ranked counties in the state for both health outcomes and factors, while Mono County is relatively highly ranked.

According to 2011 data from the Center on Juvenile and Criminal Justice (2012), Inyo and Mono Counties have relatively lower reported crime rates (aggravated assault, forcible rape, murder, robbery, arson, burglary, larceny-theft, motor vehicle theft) compared to the rest of the state. There was a decrease in reported crime rates from 2010 to 2011 in both counties and the state as a whole.

Economic Health

The unemployment rate in 2011 for the counties bordering the Inyo NF was 10.3 percent, lower than both the bio-region (14.3 percent) and the state (11.7 percent). However, 2011 average earnings in these counties ($42,935) as well as per capita income ($39,737) were lower than in the state as a whole

($60,453 earnings and $43,856 per capita income respectively). With lower earnings and lower per capita income, the counties bordering the Inyo NF are facing challenges to economic health when compared to the state.

Economic Diversity

When determining the economic context of forest management decisions, it is important to identify the key sectors that drive the economy and the extent to which the economy is dependent on forest land activities. Determining this level of diversification and the economy's dependence on these forest land activities provides a good indicator of the potential effects that may result from forest management decisions that impact these activities. Employment data in the economies of the sub-county areas surrounding the Inyo NF is, for the most part, diversified across sectors. Studies have clearly shown that local economies in this area are very dependent on tourism and recreational activities, and any changes in the level of these activities would have an effect on the economy (Alkire 2012, Gruen Gruen and Associates 2010). In addition, a recent report examining the history and potential of economic opportunities in Mono and Inyo Counties reinforces this finding, saying "neither county has demonstrated extensive economic diversification beyond the government and hospitality/leisure sectors" (Sierra Business Council 2012 p.12).

Employment projections by occupation show that the greatest increases over this decade are expected in the healthcare, personal care and service occupations, while forest-related sectors are expected to grow at a slower pace (California Department of Finance 2012b). This suggests that future trends in employment will not lead to an increased concentration of employment in forest-related sectors.

Gateway Communities

The gateway communities identified for the Inyo NF include: Lee Vining, June Lake, Mammoth Lakes, Bishop, Big Pine, Independence, and Lone Pine. These communities are all relatively small in population, ranging from around 8,000 in Mammoth Lakes to around 300 in Lee Vining. Racial makeup is somewhat consistent across these communities except for the American Indian population in Lee Vining which comprises around 50 percent of the population. Unemployment ranges from a high of 20 percent in June Lake to a low of two percent in Big Pine. Median household income varies greatly from a high of $68,167 in Lee Vining to a low of $37,005 in Bishop.

Forest Service Influence on Key Social, Cultural, and Economic Conditions

This section identifies key social, cultural, and economic conditions influenced by management of the Inyo NF. Many of the conditions previously identified provide useful context, but may not be substantially influenced by the management of the plan area to be included here. Where information is available, trends affecting these conditions are identified. At the end of this section, potential opportunities that may exist for the Inyo NF to contribute to social, economic, and ecological sustainability are discussed.

Key Social Conditions

Many people in the Sierra Nevada feel a deep connection to the land and its history. As described in Winter et al. (2013a, p.2):

> Attachment to the natural environment, influenced by natural landscapes and views, presence of wildlife, and opportunities for outdoor recreation is component of community attachment and wellbeing.

National forests in the Sierra Nevada play a major role in fostering people's connection to nature, particularly through recreation, education, and interpretation.

According to National Visitor Use Monitoring (NVUM) data from 2011, the most popular recreation activities on the Inyo NF included viewing natural features, relaxing, downhill skiing, hiking/walking, viewing wildlife and driving for pleasure. Visitor satisfaction from NVUM data can provide some sense of people's ability to connect to the land through the quality of their experiences. Overall visitor satisfaction in 2011 was high on the Inyo NF, with around 90 percent of visitors very satisfied with their visit.

National forests contribute to the wellbeing of human populations in the Sierra Nevada. People who feel connected to nature are not only more likely to protect nature, but also more likely to feel satisfied with their lives (Mayer and Frantz 2004). "The connections between human health and forests hold great potential for improvement of wellbeing" (Winter et al. 2013a, p.2). Outdoor locations offer unique opportunities to recreate and relax, providing physical and social health benefits, a chance to develop a basis for stewardship, a place to celebrate culture and family, and a place for restorative experiences (Winter et al. 2013a).

Key Cultural Conditions

Residents of the Sierra Nevada region share values around the rural and environmental qualities of the region to which National Forest System (NFS) lands contribute. A 1995 survey found that maintaining the rural character of the Sierra Nevada region is important to the majority of residents. In addition, residents strongly supported expanded efforts to preserve the region's natural resources, wanted to see their counties put more effort into conserving the natural environment, felt their counties should be doing more to permanently preserve open space and agricultural lands, and should do more to steer new development into existing towns instead of allowing it to spread all over the landscape and destroy the rural quality of life (Sierra Business Council 1997).

Sierra Nevada national forests provide opportunities for people to connect with the history and culture of the region, and to create new contributions to the region's culture and future legacy. The Inyo NF contributes to these opportunities through its cultural and historical resources. Key examples include:

- many tourists come to the Inyo NF to learn about and experience the area's rich mining history, visiting old mining workings and structures;
- the Mono Lake Bird Chautauqua has been occurring over the last decade and attracts hundreds of visitors each year;
- many other festivals and activities take place in which people explore and experience the Inyo NF, including the Lone Pine Film Festival;
- the opening days for fishing and cutting firewood are culturally important events for many people each year; and
- numerous historic logging and milling sites exist on the Inyo NF, including the historic Mono Mills area.

In the Native American community, subsistence use of forests denotes a lifestyle involving a deep connection to nature and cultural traditions (USFS 2011). Many Native Americans participate in traditional activities, such as hunting, fishing, trapping, and gathering berries, and do not differentiate these activities into distinct categories, such as work, leisure, family, culture, and tradition (McAvoy et al. 2004). Potential issues affecting traditional Native American gathering on the Inyo NF include water rights and use, access, vegetation management, fuelwood, economic opportunities, and education and outreach for tribal youth. Non-tribal groups also use the Inyo NF for traditional and cultural purposes. According to 2011 NVUM data for the Inyo NF, 3.8 percent of visitors participated in gathering forest products. The data do not differentiate between tribal and non-tribal gathering.

Key Economic Conditions

Contributing to community wellbeing by providing a broad range of economic opportunities for forest communities is consistent with current Forest Service direction from the U.S. Department of Agriculture (USDA) to generate jobs through recreation and natural resource conservation, restoration, and management in rural areas (USDA 2010). However, federal forest management alone cannot ensure community stability as jobs in the forest products and recreation industries are influenced by market conditions and changes in technology that are outside the control of forest management. As a result, national forests cannot expect to ensure community economic wellbeing through their management actions alone (Charnley 2013). However, strategies can be developed that allow forests to achieve management objectives while considering the effects on local wellbeing. Timber, recreation and agricultural production on national forest lands continue to make an important contribution to some local communities.

As of 2010, timber sector jobs in the counties bordering the Inyo NF made up very little of total private sector employment. Mining sector jobs in 2010 in the counties bordering the Inyo NF made up 0.8 percent of all private sector jobs in the counties (an estimated 88 jobs out of the 11,585 in the counties), which is more than the state and the bio-region. The majority of this employment is in metal ore and non-metallic minerals mining in Mono and Esmeralda Counties. The average annual wage for mining employment in these counties is $85,810, which is much higher than the average wage across all sectors ($37,090). This high average wage for mining is similar to the bio-region and indicates that the number of jobs in the mining sector may be low, but they are relatively high paying jobs when compared to the rest of the local economy (Headwaters Economics 2012a). Factors that may influence these markets include globally-driven prices for minerals, the cost of production in the United States vs. overseas, transportation costs, and local restraints.

Pasture and rangelands within the counties bordering the Inyo NF comprise around 70 percent of the total land area in farms, which is greater than the percentage for the state (52.3 percent) and bio-region (53 percent) (USDA 2009). In terms of number of farming operations, cattle, sheep and goat farming, which are the primary types of animals that are grazed on public lands, account for around 43 percent of all operations, more than the bio-region (22.5 percent) and the state (17.5 percent) (USDA 2009). Farm employment in these counties accounts for 1.3 percent of all employment, lower than for the bio-region (3.2 percent) and the state as a whole (1.2 percent) (U.S. Department of Commerce 2012). Limitations of this employment data include the fact that farm employment cannot be broken down by type of activity, so this specialization includes all types of agricultural employment, not only grazing and livestock operations.

In 2010, travel and tourism related industries comprised almost 50 percent of jobs in the counties bordering the Inyo NF, which is higher than the bio-region (18.1 percent) and the state (15.7 percent) (U.S. Department of Commerce 2012). The number of jobs in this sector has been relatively stable, ranging around this 50 percent of total private employment from 1998 through 2010. The average annual wage in the travel and tourism sector is $22,920, far below the $37,090 average for all private sector jobs. So while the travel and tourism sector may provide employment opportunities in the area, they are relatively lower paying jobs (Headwaters Economics 2012a).

A study examining the value of travel and tourism to California counties estimated the percentage of total county employment and earnings that is generated by all travel in the county. Travel and tourism generates 48.6 percent of employment and 32.2 percent of earnings in Mono County and 23.5 percent of employment and 11.5 percent of earnings in Inyo County (Dean Runyan and Associates 2012). A study looking specifically at the contributions from recreational use of National Forest System (NFS) land found that employment created by recreation activities specifically on the Inyo NF in 2008 provided a significant percentage of the local economic activity surrounding the forests (12.5 percent of total employment and 9 percent of total income in the area) (USFS 2008).

The fact that local economies are dependent on the visitation that results from recreational activities on the Inyo NF, along with a declining Forest Service budget to maintain the quality of existing facilities and to create the new opportunities that visitors are looking for is of concern to these communities. Going forward, it will be important for the forest to explore potential opportunities for communities to partner with the agency to fund and maintain facilities and create new recreational experiences. These opportunities include community-based stewardships, volunteerism and special uses.

Examining the flow of water from the Inyo NF shows the economic importance of this ecosystem service. Water originating on the Inyo NF supplies both water and electricity for millions of people in communities as far-ranging as Los Angeles, Mammoth Lakes, and Fresno. In addition, the water from the forest and adjacent lands is used extensively for recreational activities such as fishing, boating and swimming and aesthetic enjoyment. These recreational activities are vital to supporting the local economy in both Mono and Inyo Counties. Also, the groundwater pumped from forest lands is used both on and off the forest for uses that generate benefits for domestic, municipal, agricultural and recreational uses.

Local governments rely on revenues generated from activities on forest lands. Management decisions that affect these activities have the potential to impact these revenues. Key sources of these revenues are: (1) the sales taxes generated from timber sales and tourism, and (2) direct revenue received from the Payments In-Lieu of Taxes (PILT) and Secure Rural Schools and Community Self-Determination Act (SRS) programs.

The counties bordering the Inyo NF receive revenues from sales taxes on timber products and on temporary lodging from visitors to the area. Available data shows that these sources of tax revenue are a large source of revenues for Inyo and Mono Counties, suggesting these counties are more sensitive to changes in this revenue than the bio-region as a whole. Specifically, it is the transient lodging tax revenue that is the more significant contributor of the two tax sources (California State Controller's Office 2012). It should be noted that while the Inyo NF does contribute to travel and tourism in these counties and therefore can influence this transient tax revenue, there are other recreational opportunities in the bio-region that also drive this tourism such as other national forests and national parks, and therefore all of this revenue cannot be attributed to visitors to the Inyo NF alone. One study estimated the percentage of

the county sales tax revenue that is visitor-related. This includes spending on goods and services while visiting an area and this visitor spending accounts for 57.9 percent of sales tax revenue in Mono County and 20.8 percent in Inyo County (Dean Runyan and Associates 2012).

All of the counties bordering the Inyo NF received some level of PILT in FY 2009. These values were Inyo ($2 million), Mono ($1.4 million), Mineral ($950,000) and Esmeralda ($515,000). These values alone do not reflect the importance of these revenues to individual county budgets. Instead, looking at these PILT revenues as a percentage of total county revenues provides a measure of the importance of this contribution. For all three counties, this percentage is Mineral (10.2 percent), Esmeralda (9.3 percent), Inyo (3.3 percent) and Mono (2.8 percent) (Headwaters Economics 2012b). The future of federal payments to counties are uncertain and any potential variability in the amounts received from year to year makes planning and maintaining services difficult as the amount of revenue available to local governments is uncertain. Given limited and strained local government budgets, any loss of revenue can have a noticeable effect on the quantity and quality of services that can be provided.

Forest Service spending on the Inyo NF has increased from around $9.3 million in 2006 to around $15.2 million in 2012, mostly as a result of increases in the budgets for wildland fire management (USFS 2012b). In terms of total federal spending in the counties bordering the Inyo NF, this amounted to only a very small percentage of the approximately $312 million in total federal government expenditures in these counties in FY 2006, and was an even smaller percentage of the total economic output across all sectors of the economy over this time period (California Department of Finance 2009).

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

The history and changes of the Sierra Nevada create a complex environment for management of the national forests. Maintaining a cultural legacy is important to communities. At the same time, community wellbeing depends on the ability of those communities to adapt to a changing, uncertain future. Individuals and communities far beyond the Sierra Nevada influence the sustainability of forests and communities in the bio-region, and are likewise influenced by management decisions that take place on National Forest System (NFS) land in the bio-region. There is now a much richer understanding of the social, economic, and ecological factors in land management decisions. While challenging, this complexity highlights the robust opportunities available to the Forest Service to contribute to social, economic, and ecological sustainability. Socioeconomic factors important to this sustainability are:

- community capacity
- ecological restoration
- working together
- sustainable recreation
- connecting people to nature

Community Capacity

People who live in rural communities in the Sierra Nevada are concerned about their future. Many traditionally resource-based communities in the Sierra Nevada are in a transition period. New people have moved in from urban areas, bringing different values and changing the demographics of communities.

Ecological concerns, federal policies, and competing land uses have influenced timber harvesting and grazing. Outdoor recreation and tourism have brought new economic opportunities to communities that were formerly timber-dependent. Population growth, increased demand for recreation, competition for different uses, and ecological concerns bring with them additional challenges. In addition, tribal communities continue to struggle with maintaining a culture that is directly tied to management of and access to ancestral lands and sacred sites. Many people who live outside the Sierra Nevada are also dependent on the bio-region's ecosystem services, which can impact Sierra Nevada forests and local communities.

Community capacity is critical to wellbeing in forest communities, and can be defined as the ability of its residents to respond to internal and external stresses, create and take advantage of opportunities, and meet the needs of residents (Kusel 2001). This capacity influences the ability of communities to prepare for and adapt to change and stressors such as wildland fire and climate change (Charnley 2013).

Ecological Restoration

Management of National Forest System (NFS) lands in the Sierra Nevada can contribute to community capacity by helping people become stewards of the land as participants in ecological restoration activities (Charnley 2013). This engagement is empowering because people personally partner with land management agencies to find solutions (Charnley 2013).

Healthy forests and healthy communities are interdependent, and ecological restoration not only helps improve ecological conditions, but also offers positive outcomes for individuals and communities (Charnley 2013). Ecological restoration connects people to the land and to each other, helping communities build collective identities tied to land stewardship (Charnley 2013). Stewardship contracting is thought to be an effective tool for enhancing social and economic benefits to local communities (Charnley 2013).

Current policy for national forest management calls for approaches that accomplish ecological restoration goals, while simultaneously benefitting local communities (USDA 2010, USFS 2007). Ecological restoration as a policy in the bio-region can contribute to reducing current trends in fire and improving watershed condition, while simultaneously contributing to the sustainability of local community wellbeing. Timber vegetation treatments such as thinning reduce stand density and improve overall forest health by providing increased resilience to drought, insects and disease and wildfire. Other restoration activities on the forest include stabilizing degraded streambanks, road and trail reconstruction and maintenance, and restoration of unauthorized routes. In addition, rural communities in the wildland urban interface (WUI) are economically connected with key forest sectors such as recreation, timber (fuelwood), and grazing. A reduction in uncharacteristic wildfire as a result of restoration reduces the potential for damage to the resources on which these forest sectors are dependent. Therefore, restoration reduces the potential for disruption on the livelihood for many of the residents in these communities (Zybach et al. 2009).

Working Together

The Inyo NF relies on the added capacity that partner groups provide to carry out ecological restoration projects. As the Chief of the Forest Service said (Tidwell 2010) in order to restore the resilience of

America's forests and grasslands to disturbances of all kinds, we need to work at a scale that supersedes ownerships. Specifically:

An all lands approach brings landowners and stakeholders together across boundaries to decide on common goals for the landscapes they share. It brings them together to achieve long term outcomes. Our collective responsibility is to work through landscape-scale conservation to meet public expectations for all the services people get from forests and grasslands.

According to Charnley (2013, p.15):

> A number of researchers have found that when the Forest Service works collaboratively with local communities to develop forest restoration projects that build on local community infrastructure, resources, values, culture, and collaborative relationships and address local needs and priorities, it can be especially effective in creating local community benefits and contributing to community resilience. It is not always easy to collaborate, given declines in agency staffing and resources, and there can be challenges in the process. Nevertheless, when opportunities exist to develop projects collaboratively and align them with community needs and capacity, they are more likely to create local community benefits.

Sustainable Recreation

Outdoor recreation is major part of the culture and lifestyle in the Sierra Nevada, and in California in general. The social, economic, and ecological benefits are numerous. Outdoor recreation contributes to people's connection to nature, sense of place, and community identity. It provides physical and mental health benefits, and a foundation for stewardship. Recreation supports social interactions with friends and family, which is especially important in the Latino community. There is growing recognition of the importance that recreation volunteerism plays in California, in maintaining the quality of opportunities, as well as restoring ecosystems. Recreation is an important part of California's tourism portfolio. Population growth and resulting increases in recreation and tourism have brought new economic opportunities to many Sierra Nevada communities. The most economic activity the Forest Service generates is through recreation special uses.

Recreation in the Sierra Nevada, compounded by various stressors to the system, can also have negative impacts on social, economic, and ecological conditions. Recreation on National Forest System (NFS) lands can impact the spread of invasive species. Unmanaged recreation can adversely impact natural resources. Manipulation of streams for water recreation has degraded watersheds. Population growth has led to increased competition for water among various uses. Increasing numbers of outdoor recreationists can lead to increased conflict, and a lesser quality of experience. Recreation and tourism have led to an influx of urbanites into Sierra Nevada communities, which can increase the cost of living, and result in shifting values.

The Forest Service Framework for Sustainable Recreation provides focus areas that help us contribute by shaping the role of recreation in promoting forest and grassland health and strengthening the vitality of our communities (USFS 2010). For more information see Chapter 9 of this assessment.

Connecting People

The economy relies on society, and society is dependent on the environment. This is the general premise of the Millennium Ecosystem Assessment (2005), which recognized the growing burden that degraded ecosystems are placing on human wellbeing and economic development. It points out that sustaining the benefits ecosystems provide for human wellbeing requires a full understanding and wise management of the relationships between human activities, ecosystem change, and wellbeing in the near and long term future.

The importance of the connection between people and Sierra Nevada forests is clear. Specific and comprehensive data on people's connection with and understanding of Sierra Nevada forests is largely unavailable. However, it is clear that many people outside the Sierra Nevada feel a deep connection with the forests in the bio-region. It is important to continue to foster these connections. At the same time, many people who benefit from resources originating on the forest, such as water and electrical power, may not be aware of these benefits and may never visit (USFS 2012a). All are potential advocates, however. Several opportunities occur for developing connections where they do not yet occur, especially in many urban communities, where water demand, resource demand, and pollution all influence the health of Sierra Nevada ecosystems. Ecosystem services can be a useful framework for forest stewardship (Smith et al. 2011) by helping stakeholders identify and understand services provided by a landscape and human use and dependence on those services.

Another important piece of connecting people to Sierra Nevada forests is related to the major changes in ethnic composition that occur within and just outside the Sierra Nevada, as well as in the country as whole. According to Winter et al. (2013b, p.8):

> Increased cultural diversity in California will continue to be reflected through immigration of Latinos and Asians into Sierra Nevada communities, thus increasing the importance of attending to cultural influences and values of long-standing and newly immigrated residents. These dimensions of diversity add to the already diverse demographic, economic, and ethnic profile of Sierra Nevada communities. Both new and existing populations will challenge modes of outreach, engagement, and approaches to management. Particular attention will need to be paid to groups who may be underserved or underrepresented in opportunities to have their opinions heard, needs or interests represented in decisions about how places will be managed, and opportunities to use their public lands.

Information Gaps

While providing readily available information, some limitations exist to using U.S. Census Bureau – American Community Survey (ACS) data to describe local demographics. ACS data provide estimates that describe the average characteristics of population and housing from 2006 to 2010 and cannot be used to describe any particular year during that period. The ACS uses samples to estimate demographic data for the entire population of interest and is subject to error. Less populated areas, such as gateway communities and some CCDs, tend to have lower accuracy than at larger scales. As noted earlier, some communities were too small to be included in the ACS.

Social and cultural data specific to the Inyo NF is fairly limited. National Visitor Use Monitoring (NVUM) data provide the most relevant, reliable, and accurate data specific to Inyo NF visitation. While more recent NVUM data were collected in 2012, they are currently being processed, and only 2007 data

were available at the time of writing. While NVUM provides useful information on those already visiting the forest, it does not provide any insight into those people who do not use the forest and why. Also, while there is general or state-level information regarding the importance of national forests, other public lands, and outdoor experiences on human and community wellbeing, little information specific to the Inyo NF is available. It would be helpful to have information regarding the importance of other motivations **f**or visiting the forest beyond activities listed in NVUM, such as spending time with friends and family, physical and mental health benefits, and connecting with culture and history.

Economic data is not available at the local community level to identify the specific context of condition and trend for economic health, economic diversity and forest sector activity. Currently, this information is presented at the county and sub-county (Census CCD) level where available. Going forward during forest plan revision, it will be useful to collect any data local governments and organizations may provide to describe these more local economic conditions. Also, where data is not available, qualitative information would be useful to help describe local context and characteristics. Another current gap in economic information includes detailed information on direct forest spending in local economies (i.e. how much of spending goes to local businesses as opposed to businesses that are located outside of these local communities). This is important in order to be able to accurately identify the impacts of this spending and importance to local job creation and wages.

Another important information gap from an economic perspective is data that can be used to prioritize the benefits to people from ecosystem services so that tradeoffs, both short and long term, can be evaluated, compared and contrasted. Ecosystem services are the benefits that people obtain from ecosystems and therefore these services have a value to everyone. However, because these values are often difficult to quantify, impacts on these services can often be neglected during forest planning. The term “value“ is used here to represent something more inclusive than a monetary or dollar value but rather to capture the idea that benefits, even when they are not directly relatable to dollars spent or received, are still able to contribute to improving the quality of people’s lives. Examples of these types of non-monetary benefits are provided by key ecosystem services such as cultural heritage and biodiversity. In contrast, examples of key services that are tied to existing markets and therefore can be more directly related to monetary value are recreation, timber and water. More detail on this topic can be found in Chapter 7 of this assessment.

Chapter 7 Benefits to People

The Inyo NF is unique in the benefits and services provided to the American people. These benefits are a function of the features and landscapes found on the forest. Ecosystem services such as recreation are enjoyed directly by individuals and communities and as a result, their contribution to people’s wellbeing is more easily understood. Other vital ecosystem services provide benefits that are less apparent in people’s daily lives but are none the less important as they support and regulate the ecosystems in which people live, such as cultural heritage, carbon sequestration and biodiversity. Consideration of ecosystem services should include benefits from all of these services and therefore, the consideration of ecosystem services ensures that the complete value of forests in planning for the future and throughout the entire adaptive management process are incorporated.

Important Information Evaluated in this Phase

This chapter summarizes the information in the Inyo NF Chapter 7 topic paper. The condition and trend of these ecosystem services are dependent on the underlying resources that support them. Therefore, the information for this chapter relies on the specific resource assessments that were conducted in the other chapters of this assessment.

Nature, Extent and Role of Existing Conditions and Future Trends

The four major types of ecosystem services (provisioning, cultural, regulating and supporting) were derived from the Millennium Ecosystem Assessment classification (MEA 2005). The following lists the key ecosystem services for the Inyo NF and the chapter within the assessment where this information is discussed in detail.

Provisioning Services

Provisioning services, or the products derived from forest lands, are addressed in the following Inyo NF topic papers:

- Water – Chapter 8 "Water Uses" and to a lesser degree, Chapter 2 "Air, Soil, Riparian Areas and Water Resources", Water Resources Section;
- Timber/fuel wood – Chapter 8 "Timber"
- Grazing – Chapter 8 "Grazing"
- Fish/Game – Chapter 8 "Fish, Plants and Wildlife"
- Energy (biomass, geothermal, hydropower and wind/solar) – Chapter 10 "Assessing Renewable and Non-renewable Energy and Mineral Resources"

Cultural Services

The non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences are addressed in the Inyo NF topic papers as follows:

- Recreation – Chapter 6 "Assessing Social, Cultural and Economic Conditions", Chapter 9 "Assessing Recreating Settings, Opportunities and Access, and Scenic Character", and Chapter 15 "Assessing Designated Areas"
- Aesthetics - Chapter 9 "Assessing Recreating Settings, Opportunities and Access, and Scenic Character"
- Cultural heritage and sense of place - Chapter 6 "Assessing Social, Cultural and Economic Conditions", Chapter 12 "Assessing Areas of Tribal Importance", Chapter 13 "Assessing Cultural and Historic Resources and Uses" and Chapter 15 "Assessing Designated Areas".
- Education, science, and health - Chapter 6 "Assessing Social, Cultural and Economic Conditions", Chapter 9 "Assessing Recreating Settings, Opportunities and Access, and Scenic Character"

Regulating Services

Services that regulate ecosystem processes and benefit people are addressed in the Inyo NF topic papers as follows:

- Water quality – Chapter 2 "Air, Soil, Riparian Areas and Water Resources", Water Resources Section, Chapter 8 "Water Uses"
- Water regulation (quantity and timing) - Chapter 2 "Air, Soil, Riparian Areas and Water Resources", Water Resources Section, Chapter 8 "Water Uses"
- Carbon sequestration and regulation – Chapter 4 "Assessing Carbon"
- Ecosystem resilience (resilience to fire, invasive species, insects/disease, climate change, flooding) – Chapter 3 "Assessing System Drivers and Stressors" (especially fire and climate change), Chapter 1 "Assessing Terrestrial Ecosystems, Aquatic Ecosystems and Watersheds" (especially fire, invasive species, and insects/disease), and, to a limited degree, in Chapter 2 "Air, Soil, Riparian Areas and Water Resources" in the Water section only (flooding).

Supporting Services

Services necessary for the production of all other ecosystem services are addressed in the Inyo NF topic papers as follows. Benefits to people from supporting services are indirect or very long term.

- Biodiversity - Chapter 1 "Assessing Terrestrial Ecosystems, Aquatic Ecosystems and Watersheds",
- Watersheds", Chapter 3 "Assessing System Drivers and Stressors"
- Chapter 5 "Identifying and Assessing At-Risk Species in the Planning Process"

Information Gaps

Key information gaps for ecosystem services exist surrounding the value of these services. Going forward it will be important to begin to identify ways to prioritize the benefits to people from these services so that tradeoffs, both short and long term, can be evaluated, compared and contrasted.

Ecosystem services are the benefits people obtain from ecosystems and therefore these services have a value to everyone. However, because these values are often difficult to quantify, impacts on these services can often be neglected during forest planning. The term "value" is used here to represent something more inclusive than a monetary or dollar value but rather to capture the idea that benefits, even when they are not directly relatable to dollars spent or received, are still able to contribute to improving the quality of our lives. Examples of these types of non-monetary benefits are provided by key ecosystem services such as cultural heritage and biodiversity. In contrast, examples of key services that are tied to existing markets and therefore can be more directly related to monetary value are recreation, timber and water.

As a result of this mix of monetary and non-monetary benefits, estimating a value of the ecosystem services provided by a forest can be a complicated endeavor and must be approached on a case-by-case basis. Potential benefits will differ depending on the service being examined, the location of that service and the users of that service. For example, the same service may be provided in two locations but in one location there are few users and many alternative sources of that service, and in the other there are many users and no easy alternatives. In addition, an effort to calculate a value can be resource intensive and require considerable time and money to accomplish. Therefore, complete values for the key ecosystem

services of the Inyo NF are not presented. However, it is possible to understand the potential value of these key ecosystem services by looking at the extent of the benefits they provide.

Chapter 8: Multiple Uses–Water

Issues related to water quality, quantity, and human beneficial uses of water have been covered in Chapters 1 and 2 of this assessment and will not be repeated here. See the Chapter 2 – Nature, Extent and Role of Existing Conditions and Future Trends – Water Resources section of this assessment for more information about specific water uses on the forest, including ecosystem and human uses. See Chapter 10 of this assessment for more information on hydroelectric facilities on the Inyo NF and downstream that provide electricity for municipal commercial and agricultural uses beyond forest boundaries. See Chapter 9 of this assessment for more information on recreational water uses. See Chapter 8–Fish, Plants, and Wildlife of this assessment for more information on the use of water related to fisheries.

Water from the Inyo NF and adjacent lands is used extensively for recreation, municipal uses, and hydropower generation. Rivers, streams, natural lakes and reservoirs are used for fishing, boating, swimming, and aesthetic enjoyment. As the headwaters of the Owens River, and portions of the San Joaquin and Kern Rivers, water originating on the Inyo NF supplies water and electricity for millions of people in communities as far-ranging as Los Angeles, Mammoth Lakes, and Fresno. There are a total of 376 recorded water rights on the forest, 342 within California and 34 within Nevada. By number, and respectively domestic uses, stock watering, and irrigation comprise the most water rights. However, by water volume, municipal uses far outweigh all other uses combined. For more detailed information on trends, see the Inyo NF Chapter 8-Water topic paper.

Chapter 8: Multiple Uses–Fish, Plants and Wildlife

Hundreds of fish, wildlife and plant species are found on the Inyo NF. The presence of a variety of vegetation, wildlife, and aquatic species, in ecosystems that are visited by the public provides many opportunities for passive recreation such as nature watching, as well as active and direct connections through fishing and hunting.

Important Information Evaluated in this Phase

This chapter summarizes the information contained in the Inyo NF Chapter 8-Fish, Plants and Wildlife topic paper. Multiple-use management of forest resources contributes a range of public benefits through ecosystem services (36 CFR 219.6(b)). These ecosystem services yield both tangible (e.g. timber, range, recreation) and less tangible (e.g. spiritual, cultural, air and water quality) benefits. The multiple-use mandate under the Multiple-Use Sustained-Yield Act of 1960 (MUSYA) (16 U.S.C. 528-531) and the National Forest Management Act of 1976 (NFMA) (16 U.S.C. 1600 et seq.) is not exclusive to a single resource or use, and the sustained-yield principle applies to all multiple use purposes for which the national forests are administered.

Each of these multiple uses is assessed by defining the uses, current conditions of use and the landscape level drivers that affect the trend of those uses. Condition and trends of use are provided when information is available. The scope of these assessments is commensurate with the degree of multiple use benefits to the Inyo NF plan area. The multiple uses of these resources on the forest include:

Hunting - State agencies collect annual data for hunting permits and harvests (California Department of Fish and Wildlife and Nevada Department of Wildlife 2012 Hunting License and Data), as well as providing some general population estimates for some species by state and regional areas. The hunting section includes information on big game, upland game bird, small mammal, waterfowl, and furbearer species. The states manage non-game animals as well. These are animals for which no hunting or trapping license is required, unless otherwise noted in state regulations. These species include: English sparrow, starling, coyote, weasels, skunks, opossum, moles, black-tailed jackrabbits, badgers, raccoons and ring-tailed cats.

Angling - The success of providing desirable fishing opportunities on the Inyo NF can be indirectly measured by the trend in number of fishing licenses sold within the county. The CDFW annually records sales numbers by county. Although these numbers do not exactly reflect the number of fishing experiences that occur on the forest, they do give a general reflection of the number of people coming to the region to fish.

Wildlife Viewing - National Visitor Use Monitoring (NVUM) information was used to estimate participation in wildlife viewing on the Inyo NF. Information on bird populations was summarized from breeding bird survey information on popular bird species (Sauer et al. 2011) that occur in the Mono Lake area, such as California gulls and other shorebirds.

Wildflower Viewing - Information sources include use and visitor data from visitor center programs and front desk encounters, sales data on wildflower guides from the Eastern Sierra Interpretive Association (ESIA), visits to Inyo NF websites that pertain to wildflowers and native plants, and personal knowledge of visitor use patterns of wildflower viewing.

Native Plant Collection - Information sources for native plant uses include permit records for general botanical collection permits and special forest product permits.

Nature, Extent, and Role of Existing Conditions and Future Trends

Hunting

Wildlife species hunted in the analysis area are broadly classified by California Department of Fish and Wildlife (CDFW) and Nevada Department of Wildlife (NDOW) as:

- Big Game – mule deer, desert bighorn sheep, elk, and black bear
- Upland Game Bird – chukar, quail, blue grouse, sage-grouse, white-tailed ptarmigan,
- wild turkey and Small Mammal – rabbits and squirrels
- Waterfowl – goose, duck, and coot
- Furbearers - badgers, gray fox, muskrat, mink, beavers, raccoons, and bobcats (California), and
- beaver, mink, muskrat, otter, kit fox, red fox, gray fox, and bobcat (Nevada)

Big Game Hunting

The Inyo NF includes those portions of the several big game hunt zones which occur on the forest. Generally big game hunting occurs in the higher elevations of the White Mountains for desert bighorn

sheep, the forested areas and shrublands in the Sierra Nevada for mule deer, the forested areas in the Sierra Nevada for elk, and the forested areas in the Sierra Nevada for black bear. The number of applicants for big game tags within the hunt zones found on the Inyo NF is higher than the available number of tags, showing that big game hunting in these hunt zones is highly sought after (Nevada Department of Wildlife 2011 and California Department of Fish and Game 2012).

Based on the current conditions for big game habitat within the assessment area, the level of mule deer, elk, and black bear hunting opportunities are expected to remain stable and persist into next ten to twenty years. Habitat improvements may be needed in some areas of the forest to ensure suitable foraging habitat is available to big game species, such as mule deer. Increasing bear numbers have attracted more bear hunters to the region in recent years (Taylor personal communication 2013). This opportunity for black bear hunting will continue over time, especially near areas where artificial food sources are available and maintain higher and more concentrated bear populations. The ability to hunt desert bighorn sheep in the White Mountains may change over time because disease threatens this herd, and the impact of a changing climate on habitat that could lead to differences in use or a reduction in herd numbers.

Upland Game Bird and Small Mammal Hunting

On the Inyo NF, only chukar, quail, sage-grouse, sooty grouse, band-tailed pigeon and rabbit hunts are authorized by CDFW and NDOW. Of those, specific hunt zones have been established for chukar, quail, sooty grouse, sage-grouse, and band-tailed pigeon. In California, sooty grouse hunting is increasing in popularity as opportunities for sage-grouse hunting declines (Taylor personal communication 2013). Ptarmigan hunting is becoming more popular and is considered a unique hunting opportunity in California (Taylor personal communication 2013). More hunters are inquiring about mountain quail and sooty grouse hunting opportunities (Taylor personal communication 2013).

Current management direction allows for the continuance of suitable habitats needed for the upland game bird and small mammal species. Although there are some localized impacts from drivers and stressors, the populations of these species continue to allow for hunting use. Large scale wildfires resulting in the loss of habitat or invasive plant species lead to habitat conversions, and populations of chukar and quail may be impacted.

Waterfowl Hunting

On the Inyo NF hunting can include Mono Lake, Owens River, and Crowley Lake; however, most of these areas are surrounded by lands managed by other agencies (Bureau of Land Management) or private lands (Los Angeles Department of Water and Power) and are not under direct management of the forest. Most waterfowl hunters in the assessment area appear to be from local communities. These visitors hunt on all the large water bodies, rivers and creeks in the eastern Sierra Nevada (Taylor personal communication 2013).

While habitat for waterfowl can occur on the forest, there are many factors outside the control of the forest that influence the suitability of these areas. These include water rights associated with smaller water bodies, such as the Deschambeau Ponds, or groundwater use in communities that affect water bodies, such as Laurel Ponds. These outside factors may lead to a potential reduction in waterfowl habitat and therefore lower the potential for waterfowl hunting on the Inyo NF.

Furbearers Hunting

Furbearers can inhabit a variety of vegetation types and habitats. Beavers are restricted to riparian areas, where water sources allow for suitable foraging and potential dam building. Furbearers can be found throughout the Inyo NF. There are no specific hunting/trapping zones designated for these species on the forest. Furbearer use information could not be found for the State of Nevada. In California, trapping license information was used from 2010-2012. These results showed an increase in the amount of trapping licenses issued throughout the state.

Little information is known about furbearer populations, as California does not monitor these populations. General habitat conditions on the Inyo NF are not expected to change the conditions for furbearers. If the price of certain furbearer pelts rise, this may lead to a greater demand for trapping licenses and an increase in this type of use on the forest.

Angling

The clear, cold waters that flow through the Inyo NF are prime habitat for cold water salmonid fish, which have been introduced into these waters to provide quality fishing experiences. The forest offers suitable habitat for non-native trout species (rainbow, brook, and brown trout) and golden trout which is native to the South Fork Kern River and Golden Trout Creek located within the southernmost area of the forest. Many of the high elevation lakes and streams on the forest offer angling opportunities. The Inyo NF includes approximately 1,855 miles of perennial streams, the majority of which offer angling opportunities. There are also approximately 13,890 acres of lakes located throughout the forest, all of which are open to angling during the open fishing season.

The CDFW website offers some information on the number of angling licenses sold based on customer location and where the license was purchased, from November 2010 to December 2011. The table below summarizes this information for Inyo, Mono, and Tulare Counties, as these counties include portions of the Inyo NF.

Inyo NF angling licenses sold by county

County	Number of anglers who live within a county who purchased licenses within the county	Number of anglers who live outside the county who purchased licenses within the county
Inyo	4,746	25,667
Mono	2,906	41,907
Tulare	24,133	24,110
Total	31,785	91,684

Under current management direction, the ability to sustain angling use remains high over the next ten to twenty years. Fishing is recognized as an important economic factor for local communities and the forest will continue to provide habitat for fish. Recovery efforts for the native golden trout may lead to reductions in the ability to fish for non-native trout species in the Golden Trout Wilderness, such as rainbow trout and brown trout, but will increase the amount of fishing opportunities for the California golden trout.

Wildlife Viewing

Many different species can be seen by visitors, from common species such as red-tailed hawks and ground squirrels, to more elusive species like the Sierra Nevada bighorn sheep. Popular wildlife watching areas on the Inyo NF are the Mono Lake Scenic Area and the Eyes on Wildlife Program. The forest also recognizes that there are many other distinctive habitats (aspen, recently burned areas) or special species (sage-grouse) that add to wildlife viewing experiences. There are approximately 24,245 acres of aspen on the forest, located in the Sierra Nevada, Glass Mountains, and White Mountains. Several of these stands are accessible to vehicles and therefore offer suitable wildlife viewing areas. The National Visitor Use Monitoring Survey showed that 40 percent of visitors participated in wildlife viewing in 2006, and 35 percent in 2011. In addition, wildlife viewing ranks as the fifth most popular activity visitors participated in while on the Inyo NF.

Wildflower Viewing

Wildflower viewing is an important part of visiting the Inyo NF for many people, whether it is their primary goal, or they do it in addition to their fishing, hiking, or camping activities. The Inyo NF is popular with photographers and photography students taking advantage of the wildflower and fall color displays with the backdrop of mountain scenery. There is generally good access to wildflower viewing opportunities on the Inyo NF. Many areas with spring, summer, and fall displays are accessible via paved roads, dirt roads, and hiking trails, offering a variety of opportunities to Inyo NF visitors. Numerous wildflower guides are sold in visitor centers and bookstores in the area. The fact that all local bookstores stock these items is testament to the popularity of this activity in the eastern Sierra Nevada.

The ongoing publication and sales of new wildflower guides and increased availability of online information regarding wildflowers indicates this use is likely to continue or increase in the coming years, as long as opportunities remain available. The visitor use numbers for Inyo NF visitors here to "view natural features" increased from 50 percent to 59 percent over the past five years (USDA Forest Service 2012).

Native Plant Collection

On average, 21 special forest products (SFP) permits are issued each year, primarily for commercial seed collection, and including transplants, pine cones, and Christmas trees. The more popular areas for seed collection on the Inyo NF include the Grant Lake/Mono Lake area, and the foothills of the Sierra escarpment, along the west side of the Owens Valley. This is based on the location of high productivity areas for the desired species. Seeds include many species, but bitterbrush, sulphur buckwheat, and native grasses are the most common. Transplants, including aspen, and conifers for bonsai and other uses include lodgepole pine, western white pine, western juniper, aspen, and other species. Christmas trees have typically been pinyon pine, often sold to local organizations such as the Boosters or Boy Scouts (see also the timber section of this chapter of this assessment). Pine cones include Jeffrey, lodgepole, and western white pines.

Requests for general botanical collection permits have been relatively stable over the past several years. No change is anticipated in this use. As with wildflowers, changes in climate, fire regimes and increases in invasive species have the greatest potential to affect native plant populations and habitat in the coming years. Invasive species are perhaps the single greatest threat to native plant diversity and abundance over the next 20 years. Species desired for commercial collection could become more difficult to collect,

especially when considering the need for commercial seed companies to provide "clean" collections, i.e. collections uncontaminated by invasive species.

Contributions the Plan Area Makes to Ecological, Social, or Economic Sustainability

Nationally, fish and wildlife-related recreation is clearly an important leisure activity, with more than 90.1 million Americans, 16 years of age and older, participating in 2011 (USDI – USFWS 2006). An average of four out of ten people participates in some type of wildlife recreation.

Fish and wildlife recreation is an important leisure activity and a catalyst for economic growth. Hunters, anglers and wildlife watchers spent $145 billion on wildlife-related recreation in 2011. This spending contributed to local economies throughout the country, which added to employment, raised economic output, and generated tax revenue. Such activity provides jobs and income to communities, helps maintain social cultures, maintains long-standing traditions, connects people to the land, and contributes to the quality of life for many Americans and tribal nations.

Hunting

From 2003 to 2008, the Forest Service's National Visitor Use Monitoring (NVUM) program reported an annual 14.4 million visits to National Forest System (NFS) lands for the primary purpose of hunting (Mockrin et al. 2012). Total expenditures from these visits were almost $1.2 billion for hunting. Annually from 2000-2003, hunters expended nearly $50 million in or within 50 miles of national forests in California. These expenditures are the equivalent of 714 full and part time jobs and 3.7 million in federal tax revenues. Expenditures are substantially greater when considering all trip-related and equipment purchases within California attributed to USFS wildlife recreation (American Sport Fish Association 2008). Hunters annually spent $4.2 billion from 2000-2003 for Forest Service hunting activities, supported 97,000 jobs and generated $505 million in federal income tax revenues.

Angling

Nationally, there were 11,600,000 visits to national forests in 2011 attributed primarily to angling (USFS 2011). Recreational fishing is also popular across California. During 2006, an estimated 1.7 million anglers spent a projected $2.4 billion associated with fishing in California, which supports jobs in local communities. Of these total anglers, approximately 1.2 million were associated with freshwater angling, spending an estimated $1.1 billion (USDI-USFWS 2006). With a variety of streams, reservoirs, and high elevation lakes, fishing is a popular recreational activity on the Inyo NF.

Nature Viewing and Plant Gathering

Nature viewing and plant gathering provides economic and social benefits. Communities benefit economically from these visitors who spend money in hotels, restaurants and shops during their visits. As a result, travel and tourism contributes to local economies supporting local jobs and earnings. Chapter 6 of this assessment provides information on the importance of visitor spending to the local economies surrounding the Inyo NF.

Plant species have important uses related to cultural heritage and use. Ethnobotany studies have identified a number of these important cultural species that provide medicinal, food and hunting benefits to Native American tribes in California (Reid et al. 2009, Anderson 1996). These types of benefits may be difficult to value monetarily, but are critical in sustaining and improving the quality of life for those users.

Information Gaps

Systematic inventories to document the population trends of several deer herds and other hunted species on the Inyo NF do not exist. Current distribution and population estimates of hunted species are generally based on anecdotal accounts and historical records from state and federal biologists. In addition, California Department of Fish and Wildlife does not report hunter success by forest. It only reports by hunting unit boundaries (zones), therefore it is difficult to determine the number of hunted species taken in any given year inside the forest boundary.

Chapter 8: Multiple Uses-Range

Important Information Evaluated in this Phase

This chapter is a summary of the Inyo NF Chapter 8-Range topic paper. The information sources used are:

- 2230 term grazing permit files
- 2210 range analysis and planning (annual forage utilization/monitoring data)
- Vegetation and watershed condition data collected under Amendment 6 of the 1988 Inyo NF LRMP
- Proper functioning conditions stream channel assessments

Nature, Extent, and Role of Existing Conditions and Future Trends

Livestock Grazing

There are 49 livestock allotments on the Inyo NF. Thirty-eight of the allotments are active. In 2012, 4,717 head of cattle and 15,350 head of sheep were permitted to graze at various times throughout the year on the forest, with the primary grazing season between June 15 and September 30. A total of 24,425 animal unit months (AUMs) were authorized to graze under a term grazing permit on National Forest System (NFS) lands, and 10,555 AUMs were authorized under on/off permits, with one temporary permit for 418 AUMs. The table below displays this information.

Livestock use on the Inyo NF

Type of permitted use	Total for term permits (AUMs)	Total for on/off permits (AUMs)	Total for temporary permits (AUMs)	Total for all permits (AUMs)
Total permitted number of cattle	3,808	819	90	4,717
Total permitted HM* of cattle	9,425	9,226	317	18,968
Total permitted AUM of cattle	12,441	10,434	418	23,293
Total permitted number of horses (on cattle permits)	20	0	0	20

Type of permitted use	Total for term permits (AUMs)	Total for on/off permits (AUMs)	Total for temporary permits (AUMs)	Total for all permits (AUMs)
Total permitted HM of horses (on cattle permits)	61	0	0	162
Total permitted AUM of horses (on cattle permits)	73	0	0	194
Total permitted number of sheep	15,350	0	0	15,350
Total permitted HM of sheep	44,632	0	0	44,632
Total permitted AUM of sheep	11,911			11,911
Total permitted AUM of combined cattle, horse and sheep	24,425	10,555	418	35,398
Total permitted HM	54,118	9,327	317	63,762

* Head month (HM) is one month's use and occupancy of range by one weaned or adult animal, bull, steer, heifer, horse, burro, mule or five sheep or goats. One AUM is the amount of forage required by an animal unit (AU) for one month, or the tenure of one AU for a one-month period.

Rangeland Condition

Within the last ten years, condition data has been collected from key areas on 32 allotments on the Inyo NF. Data includes vegetation condition, watershed condition, and stream channel assessments. Because of the varied differences in rangeland types, the allotments have been grouped into similar ecosystem types to facilitate management. These groups are: Kern Plateau, Desert Allotments, Crowley Lake, Mono Lake, White Mountain, Bishop, and Inyo Mountain. Ratings for vegetation across the forest show that 103 key areas (75 percent) fall within the desired condition for vegetation across the forest. Twenty-seven key areas (20 percent) are in fair condition, and six key areas (four percent) are in poor condition. The table below displays this information.

Allotment condition data

Type of key areas and vegetation ratings	Desert	White Mountain	Crowley Lake	Kern Plateau	Mono Lake Area	Total
Upland Sites						
Excellent	6	1	25	2	8	41
Good	0	3	10	3	0	14
Fair	0	1	5	1	4	11
Poor	0	0	1	0	0	1
Meadow Sites						
Excellent	0	9	2	22	0	24
Good	0	2	3	19	0	24
Fair	0	0	6	9	1	16
Poor	0	0	5	0	0	5

Watershed condition ratings show that 71 key areas (50 percent) rate as "fully functional", 47 key areas (33 percent) rate as "functioning at risk", 29 key areas (20 percent) rate as "degraded" and six key areas

(four percent) rate as "non-functional". For stream reaches within grazed allotments, 67 reaches (59 percent) are "properly functioning", 42 reaches (37 percent) are "functioning at risk" (with different trend ratings), and five reaches (five percent) are "non-functioning. The table below displays this information.

Watershed condition ratings

Type of landform and watershed rating	Desert	White Mountain	Crowley Lake	Kern Plateau	Mono Lake Area	Total
Upland Sites						
Fully Functional	6	2	9	1	11	29
Functioning at Risk	0	0	25	2	0	27
Degraded	0	0	5	0	0	5
Non-functional	0	0	3	0	0	3
Meadow Sites						
Fully Functional	0	7	4	33	1	42
Functioning at Risk	0	3	6	11	0	20
Degraded	0	2	6	6	0	14
Non-functional	0	1	0	1	0	3
Proper functioning condition ratings						
Properly functioning	6	7	24	33	0	67
Functioning at risk-upward	0	2	2	17	0	21
Functioning at risk-trend not apparent	0	1	4	4	0	9
Functioning at risk-downward	0	1	8	3	0	12
Non-functioning	0	0	3	2	0	5

Livestock grazing has the potential to adversely affect water quality. The Inyo NF conducts annual monitoring of range best management practices (BMPs) to evaluate impacts to water quality and aquatic habitat. The forest has completed 24 evaluations of range allotments since 1992 using the Forest Service Pacific Southwest Regional G24 Protocol for BMP monitoring. Like all BMP protocols, G24 provides a method of determining whether the forest correctly implemented BMPs and whether these BMPs were effective in protecting water quality. Of the total of 24 evaluations, 16 were rated as both implemented and effective. Another four rated as implemented at risk, meaning that although the BMPs were correctly implemented, minor departures from effectiveness were noted. The remaining four evaluations were rated implemented but not effective, meaning that although the BMPs were implemented as planned, they were not effective in preventing adverse effects on water quality. The primary reasons for lack of effectiveness were impacts to water flow and extent and habitat disturbance. Both of these indicators are related to the degree of mechanical disturbance of water sources and other sensitive areas by livestock. Effectiveness can be improved by limiting the access of cattle to impacted areas, reducing stocking rates, or changing seasons of use.

If implementation of the current 1996 Inyo NF LRMP Amendment 6 grazing management strategy were to continue, vegetation and watershed condition trends are expected to improve, or continue to improve, for the next 20 years. Adaptive management, which is a key component of the Amendment 6 process,

allows managers to take action to adjust utilization allowances or even grazing management strategies to facilitate the upward trend of meadow and upland grazing sites. Improved meadow, riparian and upland sites will result in increased forage available to grazing animals, along with improved overall ecological health of rangelands, which benefit native fauna as well.

Contributions the Plan Area Makes to Ecological, Social, or Economic Sustainability

Livestock permittees who use National Forest System (NFS) lands on the Inyo NF contribute to the local economy in Inyo and Mono Counties. In addition, local ranchers and forest permittees contribute to the social and economic sustainability of the local community. These families participate and support many local activities and community tourism events.

Economic sustainability of these ranches owned by permittees over the next 20 years is the most difficult to predict. Their future will depend on the ability to maintain a viable and profitable livestock operation based on the availability of a sustainable forage base. Ranchers are already faced with the need to manage for diverse goals and have been encouraged to produce products with a higher market value, such as organic and natural meats. In most cases, it is the herd size authorized in the Forest Service grazing permit that limits the ability of many permittees to rely on ranch income alone. Each permit has a certain capacity, resulting in a set number of permitted livestock that the range can support for the season of authorized use. Many permittees have already diversified their operation to supplement their income from part-time to full-time off-ranch work.

In order to cope with reductions of National Forest System (NFS) lands for summer grazing, ranchers favor leasing more private land. However, these lands are in short supply and there is strict competition for the leases. In a 2002 University of California Berkeley report to the Sierra Nevada Alliance, 40 to 50 percent of ranching income was attributed to their access to these summer grazing lands. Those interviewed who graze on NFS land said they have no desire to sell their ranches, but a third stated that they would have to consider selling if they lost their Forest Service grazing permit. The majority of ranchers surveyed responded that living and working amidst natural beauty was a highly important reason to continue ranching, and that although ranching is not seen as the ideal way to make a living, most ranchers want their children to continue ranching and to pass on the family tradition (Sulak and Huntsinger 2002).

Information Gaps

In 2012, the Forest Service and the University of California Davis Rangeland Watershed Laboratory established a partnership to conduct the first comprehensive analysis of the long term monitoring program dataset. Researchers and Forest Service rangeland specialists are currently in the process of examining these data to determine meadow conditions and trends, and relationships between meadow conditions and trends, livestock management, weather and environmental drivers. When the information is available, it will be used to inform the analysis supporting plan revision as applicable. This study will represent the most scientifically updated assessment of trend and response to grazing management, as well as to weather and other factors on national forest meadow and riparian rangelands.

Meadow health will be assessed using the rooted frequency (Bonham 1989) data to calculate a suite of indicators of meadow condition and trend, including species richness, diversity (Simpson's and Shannon-

Wiener indices) and evenness. Soil stability scores (Burton et al. 2010,Winward 2000) will also be calculated from plant functional trait groups, which are based on life form, life span, plant height, growth form (clonal or not), and nitrogen fixing ability.

For information and current status of the study as well as preliminary analysis of long term monitoring sites on the Inyo NF, please go to the University of California Davis Rangeland Watershed Laboratory website.

Chapter 8: Multiple Uses–Timber

Important Information Evaluated in This Phase

This chapter is a summary of the Inyo NF Chapter 8-Timber Topic Paper. The following data sources were used to compile the timber data presented in this chapter:

- U.S. Forest Service - Pacific Southwest Region, Western Core Tables
- Inyo NF Annual Vegetation Inventory (2009);
- Forest Activity Tracking System (FACTS), a database tracking forest vegetation management activities since 2004
- Forest Service Corporate Data Warehouse (CDW)
- Forest Service Timber Information Management System (TIMS), a database tracking timber sale volumes and values

Nature, Extent, and Role of Existing Conditions and Future Trends

Current Condition and Future Trends

The Inyo NF contains approximately 62,000 acres of productive forest land that are suitable for active timber vegetation management. While the forest continues to steadily implement forest health and resilience treatments on these suitable productive forest lands, it is growing wood at a rate over four times faster than the rate treatments are being implemented. The table below presents the species composition mix for the primary forest timber location, the Mammoth Lakes – June Lake core timber management area.

Species composition mix on the Inyo NF for Mammoth Lakes-June Lake core timber management area

Forest Type	Acres	Percent
Jeffrey Pine	49,370	80
Lodgepole Pine	7,934	13
Mixed Conifer	3,814	6
Red Fir	878	1

The Mammoth Lakes – June Lake core timber management area has 50 to more than 400 trees per acre and is typically dominated by 80 to 120 year old trees, averaging 8-14 inches in diameter breast height (dbh) and 40-70 feet in total height. Diversity is often limited by the excessive number of trees growing in the stands and the overall lack of older, larger trees. In addition, some stands are nearly devoid of any younger, smaller trees due to a lack of openings for establishment of new growth.

The Inyo NF conducts timber vegetation treatments aimed at reducing stand density by thinning to improve overall forest health through increased resilience to drought, insects and disease and wildfire. The methods in use for completing commercial thinning treatments include commercial timber sale, stewardship contract, service contract, and the Inyo NF workforce.

The Inyo NF abandoned even-aged forest management practices (overstory removal and regeneration cuts) in the early 1990s, in favor of the current thinning practices to promote forest health and resilience. Overstory removal and regeneration cuts generated high volumes of timber sold each year. These management practices also resulted in abundant reforestation opportunities to replace trees removed in regeneration cuts. In contrast, current thinning prescriptions generally result in the largest, healthiest, most vigorous growing trees being retained as growing stock while the lesser trees are removed. Thinning reduces the number of trees on a site, allowing remaining trees to increase crown and photosynthetic production, resulting in increased diameter and height growth on the remaining trees. Reforestation as a result of harvesting is no longer required and the only tree planting occurring on the Inyo NF in the last decade has been to replace stands lost as a result of high-intensity wildfire.

Wildland Urban Interface Fuels Reduction and Forest Restoration Projects

Since approximately 2001, the Inyo NF has received annual appropriations from Congress targeted at fuels reduction, with special emphasis on hazardous fuels reduction in the wildland urban interface (WUI) surrounding communities such as Mammoth Lakes and June Lake. Within the 62,000 acres defined as suitable productive forest land in the Mammoth Lakes – June Lake core timber management area, approximately 15,000 acres are considered to be within the various WUI zones as defined by the Sierra Nevada Forest Plan Amendment (2004). Since 2002, approximately 4,000 of these WUI acres have received or are in planning stages to receive fuels reduction treatment.

Prescribed fire is also an extremely important treatment method benefitting the timber resource, both in and out of the WUI. Activity fuels or "slash" associated with commercial and pre-commercial thinning treatments commonly pose an increased fire severity risk to the remaining trees growing in a stand. To mitigate this risk, slash is often hand or machine piled and the piles burned when it is safe to do so, usually during the early winter months. Near homes or communities, where pile burning is not an option, slash chipping is often used to reduce the activity fuels. Since 2004, the Inyo NF has averaged 500 acres of pile burning annually in the Mammoth Lakes – June Lake core timber management area.

The final treatment in the suite of treatments usually recommended for the forested stands of the Mammoth Lakes – June Lake core timber management area is low to moderate under burning to reduce decades of surface fuels build-up, recycle important nutrients into the soil, and provide opportunity for younger plant and shrub life to replace older, more decadent age classes. The Inyo NF has a long history of using prescribed fire to under burn in the suitable productive forest lands following thinning treatments. Since 1999, the Inyo NF has under burned approximately 10,300 total acres, 735 acres on average annually.

Current Levels of Timber Harvest and Production in the Plan Area and Within the Broader Landscape

Timber volumes sold and cut to commercial operators stabilized greatly after 1998, when the last harvesting of large diameter sawlogs from earlier 1990s offerings was completed and the Inyo NF transitioned to commercial thinning of small to medium-sized trees. The year 2012 appears as an anomaly resulting from salvage sales in the Red's Meadow area of the Mammoth Ranger District where extensive blowdown of large diameter, high-volume fir and pine trees greatly increased the volume sold for this one year.

The Ability of Timber Harvest to Affect Forest Resilience to Stressors such as Fire, Insects, and Disease

Climate Change

Projected future temperatures appear to continue the warming trend, while projections for precipitation are more uncertain. In the short term, management practices that result in lower tree densities may provide for increased resilience. Well established research indicates that lower stocking levels result in reduced tree mortality.

Reestablishing forests, after stand replacement wildfires with seedlings from selected seed sources may also provide some level of resilience in the longer term. Establishing conifer genotypes from lower elevations or more southerly latitudes may provide for an adaptive advantage when facing a warming climate.

Fire

Over past centuries, fire has played a dominant role in shaping these forested stands. The natural fire regime for most of the pine and mixed conifer forests in the Mammoth Lakes – June Lake core timber management area is characterized as frequent, low-intensity surface fires or "Fire Regime I," as described by Hann and Bunnell (2001).

Insects and Disease

Overly dense forest conditions have also contributed to increased insect and disease problems. From the late 1990s through the early 2000s, drought, a significant increase in Jeffrey pine bark beetle and fir engraver beetle activity, and increased tree mortality was observed on the Inyo NF. More recently the forest has suffered extensive loss of whitebark pine trees in the sub-alpine regions to a mountain pine beetle outbreak. In addition, the current overly dense, more horizontally uniform stand conditions make tree-to-tree spread of annosus root disease more likely, increasing the likelihood of excessive tree mortality caused by this root disease. At this time, annosus root disease is not known to be causing excessive mortality in the core timber management area.

Current Capacity and Trend for Logging and Restoration Services and Infrastructure for Processing Wood within the Broader Landscape

The ability of the timber industry to respond to increased timber volume opportunity and production varies with milling infrastructure, logging infrastructure, and product transportation. Transportation may

adjust quickly depending on general economic and market alignment. Difficulties in the recovery of this sector involve high capital costs of equipment acquisition, operation, and maintenance, adequate workforce recruitment and training, and improved operating season to support high value employees and their families.

Recently, log transportation costs have increased 20 percent. Traditionally, trucking costs have fluctuated with the cost of fuel and labor costs. Part of the recent increase may be a temporary effect of the modernization of the local truck fleet as it updates equipment to new California state standards. Viable trucks are in short supply.

No local milling facility capable of handling a substantial volume of sawlogs exists. The nearest mill is Sierra Forest Products in Terra Bella, California several hundred miles away. Fuel costs make transportation to these facilities prohibitive.

Key Trends that Drive Supply and Demand for Timber or Timber Harvest in the Plan Area

Markets for local wood products are limited by the value of the material offered from Inyo NF lands and the relative isolation of the eastern Sierra Nevada from processing facilities and larger urban markets. For example, because no local milling facility capable of handling a substantial volume of sawlogs exists, the high-quality fir and pine logs from the blowdown in the Red's Meadow area had to be hauled several hundred miles by truck to the Sierra Forest Products mill in Terra Bella, California. Inyo NF fuelwood and bagged firewood are occasionally exported out of the local area when favorable economic opportunities exist. Likewise, commercial fuelwood operators sometimes supplement their wood supplies with material from outside the local area.

There are approximately five active local fuelwood concerns operating in the Mammoth Lakes – June Lake core timber management area that regularly submit offers on Inyo NF commercial fuelwood sales. The capacity of these purchasers to buy, process, and market Inyo NF wood products is limited by the relative isolation of the eastern Sierra Nevada communities from larger, more distant population centers such as southern California.

Another important use is the Inyo NF personal use fuelwood program that provides the opportunity for the general public to collect fuelwood for home heating directly off forest land. Since 2000, the Inyo NF has annually averaged approximately 1,800 permits issued for 4,400 CCF (hundred cubic feet) through this program, approximately two-thirds of the forest's average annual volume sold.

If current Inyo NF timber vegetation management practices favoring commercial and pre-commercial thinning treatments aimed at improving overall forest health continue, current timber harvesting practices are likely to continue as well. Commercial and personal use fuelwood are expected to continue to be the dominant forest product on the forest. The personal use fuelwood program is expected to continue to offer affordable and popular opportunities for home heating in the eastern Sierra Nevada in the years to come. In addition, hazard trees will continue to contribute unpredictable timber volume sold each year.

Contributions the Plan Area Makes to Ecological, Social, or Economic Sustainability

Vegetation management through restoration required to maintain forest habitat under the anticipated environmental stresses described in Chapter 3 of this assessment is critical to respond to potential increased mortality from drought, fire, insects, and disease. Forest capital resources, both human and financial will be stretched.

Even-age silvicultural stand management tools for timber production were largely replaced by interim thinning entries, gradually evolving toward all-age silvicultural methods, for habitat conservation and development. Heavy harvests for regeneration purposes produced larger, more valuable logs which funded transportation access and reforestation. The retention of timber receipts in trust funds for reforestation and other resource enhancement provided for plantation creation in the 1990s and tending, as well as low canopy fuel reductions in natural stands.

The vast majority of local processing of forest products is for fuelwood. Milling of timber resources for products other than fuelwood is minimal and limited to a few local individuals who manufacture items such as post and poles, rough siding, arts and crafts, furniture and other products.

Thinning produces many smaller, less valuable logs, reducing the ability of timber extraction to fund other concerns beyond restoration projects, slash treatment and road maintenance. Since 2000, there has been a general shift from plantation creation and stocking control funded by timber dollars, toward natural stand understory thinning and fuels reduction, funded increasingly by fuels dollars.

Timber requirements are addressed in the 2012 Planning Rule at 36CFR219.11. Plan components must ensure that no timber harvest for the purpose of timber production may occur on lands not suitable for timber production, timber harvest would occur only where soil, slope or other watershed conditions would not be irreversibly damaged, would be carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation and aesthetic resources, and contains direction on the maximum size of openings allowed. The 2012 Rule at 219.11(d)(6) as amended on April 19, 2013 states the: "quantity of timber that may be sold from the national forest is limited to an amount equal to or less than that which can be removed from such forest annually in perpetuity on a sustained yield basis." Scheduling of regulated timber harvest and its associated allowable sale quantity (ASQ) will be addressed as part of forest plan revisions and will be addressed in the National Environmental Policy Act (NEPA) analysis phase of the upcoming Inyo NF plan revision effort, including the calculation of an updated long term sustained yield.

Information Gaps

Yield tables commonly used to determine desired stocking levels were generally developed in the late 1920s and early 1930s by Meyer, Dunning and Reineke, and Schumacher, when vegetation had been growing under cooler and wetter conditions than are currently being experienced.

Use of these stocking guides should be adjusted for warmer, drier conditions possibly leading to decreased site productivity (reduced stocking and growth potential).

More recently, the Inyo NF, like many areas in the western United States, has suffered extensive loss of whitebark pine trees in the sub-alpine regions to a mountain pine beetle outbreak. Changes in climate are suspected to be a contributing factor.

Chapter 9: Recreation Settings, Opportunities and Access, and Scenic Character

Important Information Evaluated in This Phase

Existing, relevant information about recreation settings, opportunities, access, and scenic character of the plan area were identified and evaluated. Factors that may influence the demand for recreation in the plan area or the ability of the plan area to meet those demands were also evaluated. Finally, this information was used to discuss the sustainability of recreation in the plan area. This chapter summarizes information from the Inyo NF Chapter 9 topic paper. Assessment information related to wilderness, scenic byways, national trails, the Mono Basin National Forest Scenic Area, the Ancient Bristlecone Pine Forest, and other designated areas are addressed in Chapter 15 of this assessment. Mileage figures presented here are slightly different than those presented in Chapter 11 due to the use of different data sources for the information.

Nature, Extent and Role of Existing Conditions and Future Trends

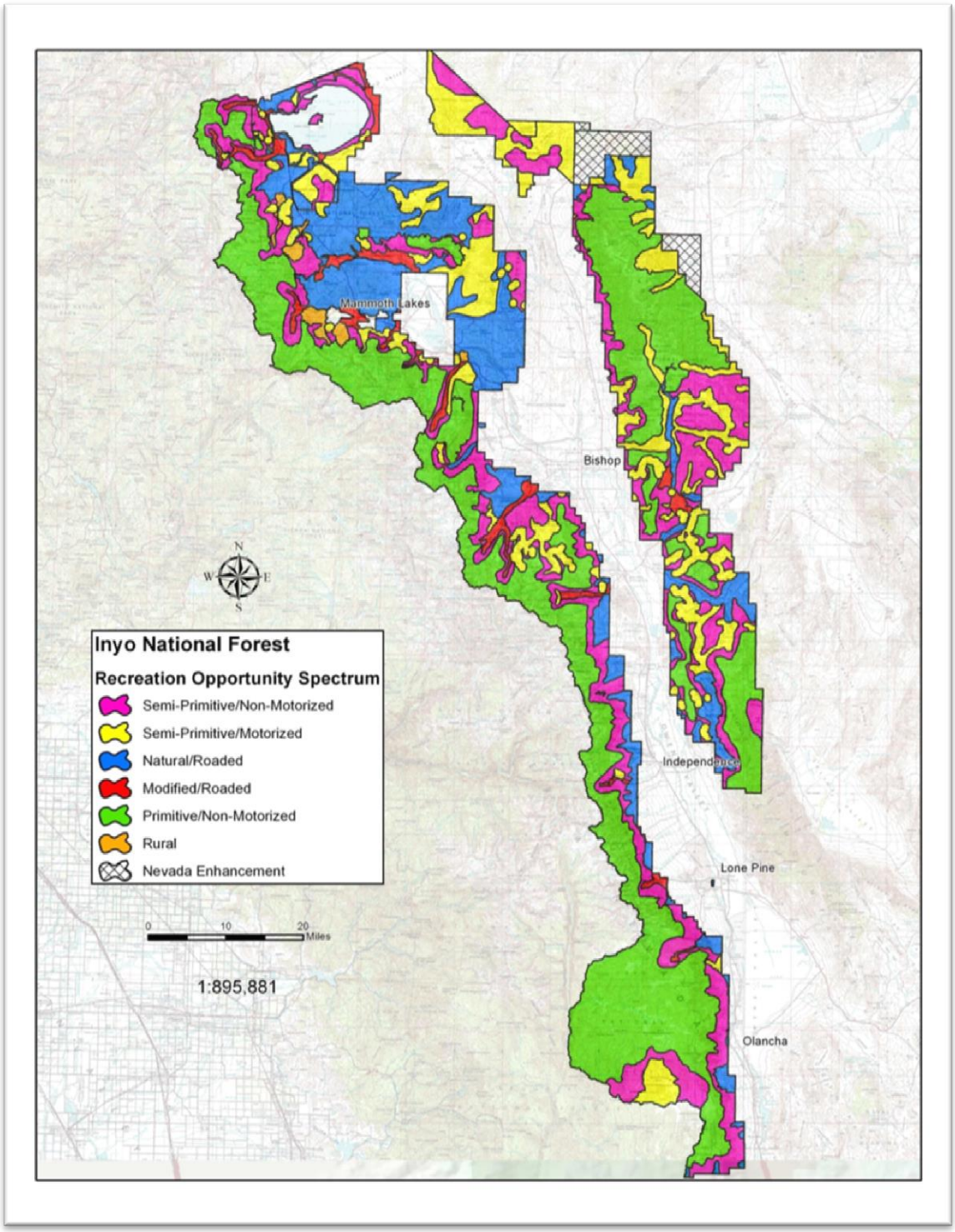
Recreation Settings

Recreation settings are the social, managerial, and physical attributes of a place that, when combined, provide a distinct set of recreation opportunities. The Forest Service uses the Recreation Opportunity Spectrum (ROS) to define recreation settings and categorize them into six distinct classes: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban (36 CFR 219.19).

ROS classes for the Inyo NF were originally established under the 1988 LRMP. The Inyo NF subdivided the roaded natural category to include another class called roaded modified. The table and map below display the ROS classes on the Inyo NF.

ROS classes on the Inyo NF

ROS Class	Acres	Percent Total Acres
Primitive	790,306	38
Semi-primitive non-motorized	471,686	22
Semi-primitive motorized	331,964	16
Roaded natural	335,756	16
Roaded modified	62,507	3
Rural	15,545	1
Urban	0	0
No assigned class	93,483	4
TOTAL	2,101,247	100



Inyo NF Recreation Opportunity Spectrum (1988 LRMP)

Starting in 2007, recreation facility analyses (RFAs) were conducted nation-wide to address growing concern about the agency's ability to maintain recreation sites to meet the needs of the public. The goal was to align management of recreation sites and facilities with the forest's recreation program niche and economic capability. Since 2007, national forest recreation programs throughout the country have been guided by recreation program niche statements and complementary niche settings developed through the RFA process. Niche statements broadly define the scope of a national forest's recreation program and highlight those aspects that are distinctive.

The following is the niche statement for the Inyo NF (USFS 2007):

> *The Inyo National Forest is characterized by large magnificent mountains that invite and inspire visitors locally, regionally, nationally, and internationally. The word INYO is Paiute for "Dwelling place of a great spirit". This stunning landscape is home to well-known attractions such as Mt. Whitney, Mono Lake, the Ancient Bristlecone Pine Forest and the Mammoth Mountain. These icons, along with the forest's proximity to other recreation attractions, make the Inyo a destination place for visitors who typically drive at least 4 hours to experience this amazing national forest. Travelers on routes and trails pass through contrasting landscapes that intrigue them to learn more. Year-round trail use provides the means to high quality recreation from hiking, Mtn. biking, and equestrian use, to skiing, snowmobiling, and other motorized uses (SUVs, 4wd, ATVs, motorcycles, etc.). Conservation education and interpretation focus on developing a land ethic as part of the recreation experience. Staffed visitor centers and Forest employees at renowned attractions help people learn about and connect with this special place.*

The Inyo NF has four niche settings, which represent broad geographic areas that provide a contiguous backdrop for particular opportunities and activities. These include: hub, scenic routes, explore, and wild. ROS classes described above are considered a finer-scale subdivision of these niche settings; however, niche settings from the RFA process have not yet been integrated with the ROS classification system. The function and nature of niche settings are described using one or more of the following landscape character categories: naturally evolving, natural appearing, cultural, pastoral, agricultural, historic, and urban. Conditions and trends affecting recreation settings are discussed below by examining the components that contribute to recreation settings, including opportunities, access, and scenic character.

Several suggestions were received regarding the forest's recreation niche as part of the public comment on the draft version of this topic paper. All who commented agreed about the importance of recreation on the Inyo NF for tourism to support the local economy and for providing valued outdoor experiences to those who live and visit the forest. Beyond this general consensus, the suggestions expressed divergent viewpoints on the focus for management of recreation and the niche of the Inyo NF.

Recreational Opportunities

A recreation opportunity is an opportunity to participate in a specific recreation activity in a particular recreation setting to enjoy desired recreation experiences and other benefits that accrue. Recreation opportunities include non-motorized, motorized, developed, and dispersed recreation on land, water, and in the air (36 CFR 219.19).

The Inyo NF manages for a set of outdoor recreation opportunities that are consistent with the forest's niche and ROS classifications. The opportunities may be provided by the Forest Service directly, or under a special use permit.

Non-Motorized Recreation

Non-motorized activities such as downhill skiing and hiking/walking are popular on the forest and have maintained some of the highest participation rates according to National Visitor Use Monitoring (NVUM) data. The majority of acreage on the Inyo NF provides for non-motorized activities. These areas largely coincide with the 46 percent of the Inyo NF that Congress has designated as wilderness. The Inyo NF offers non-motorized access on a total of 999 miles of standard trails and 48 miles of snow trails. Three-quarters of the standard trails are located in wilderness, where only primitive means of travel is permitted, such as hiking, equestrian use, ski mountaineering or snowshoeing. The remaining one-quarter of the standard trails offer a wider variety of non-motorized travel options, such as mountain biking, and bicycling or roller blading on paved paths. Approximately one-third of the over snow trails are groomed by permit holders as an authorized special use. All of the non-motorized snow trails are located outside of wilderness, and are available for a variety of "quiet" travel options, including cross-country skiing, snowshoeing or walking.

Motorized Recreation

Wheeled motorized use is restricted to designated routes that can include paved highways and roads, gravel or native-surfaced Forest Service roads, and trails designated for motorized travel. The forest provides 340 miles of motorized trails, and 2,826 miles of roads for motorized use. Many of these roads and trails offer opportunities for over snow motorized recreation opportunities during the winter (i.e. snowmobile). The forest provides 225 miles of over snow trails with motorized access on the north zone of the forest in Mono County. Approximately 80 miles of the over snow trails are groomed by either the Forest Service or by permit holders as an authorized special use.

The majority of motorized recreation opportunities are available in the semi-primitive motorized and roaded natural ROS classes, though motorized opportunities are found in all ROS classes. According to NVUM data, driving for pleasure is the most popular motorized activity on the forest.

Developed Recreation

The Inyo NF has a total of 455 developed recreation sites, the majority of which are found in the roaded modified and rural ROS classes. They include 70 campgrounds, 16 group camps, 2 horse camps, 28 picnic or day use areas, 5 boating sites, and 1 swimming site. Many of the campgrounds are operated under special use permit by concessionaires.

Dispersed Recreation

Dispersed recreation occurs throughout the forest where there are few or no facilities. Dispersed recreation occurs throughout the forest in undeveloped or general forest areas where there are few or no facilities. Dispersed recreation includes the full suite of outdoor motorized and non-motorized recreation opportunities, available throughout the year. Activities include, but are not limited to, camping, hiking, off highway vehicle driving or riding, rock climbing, mountain biking, wildlife viewing, fishing, hunting,

cross-country skiing, snowmobiling, visiting historic sites and scenic areas, and exploring the forest. Dispersed recreation opportunities are found in all ROS classes.

Important Recreation Sites or Areas

Some key recreation sites or areas on the Inyo NF include Mt. Whitney, Mammoth Mountain Ski Area, Mammoth Lakes Basin, Mono Lake, June Lake, Coyote Flat, Bishop Creek, Whitney Portal, Papoose Flat, the Ancient Bristlecone Pine Forest, Reds Meadow, the Buttermilk climbing area, the Kern Plateau, Ansel Adams and John Muir Wildernesses, and Rock Creek. Many of these key recreation sites or areas occur within the hub recreation settings, which are comprised of well-known attractions that receive high amount of concentrated recreation use.

Special Uses

Recreation special use permits allow for occupancy and use of national forests. Permitted recreation uses provide opportunities to the public for services not offered by the Forest Service, and deliver economic benefits to rural economies. Some uses are commercial enterprises that offer services for a fee. They are operated by businesses, private entrepreneurs, non-profit groups, and semi-public agencies. Examples include outfitting and guiding, resorts, campgrounds, organizational camps, and private camps. Non-commercial recreation uses consist of sites or activities that do not serve the general public but are reserved for use by specific groups, such as clubs or by individuals and families. The Inyo NF currently manages 504 active special use authorizations, displayed in the table below. A single permit can authorize use in multiple forest locations.

Inyo NF special use authorizations

Type of Recreation Special Use Authorization	Number of Authorizations
Recreation residence	348
Outfitting and guiding service	48
Boat dock & wharf	39
Resort	29
Recreation event	10
Concession campground	6
Marina	5
Livestock area	4
Organization camp	3
Other commercial public services	2
Fish hatchery	2
Private lodging - coop, condo, cabin or trailer court	1
Service station	1
Winter recreation resort	1
Ski lift or tow	1
Park or playground	1
Visitor center, museum	1
Education center	1
Amateur radio	1

Conditions and Trends Affecting Recreation Opportunities

Public Preferences and Demand

Recreation opportunities are affected by recreational trends and the mix of outdoor activities chosen by the public, which continuously evolve (USFS 2012). National Visitor Use Monitoring (NVUM) data provide information on visitor use and visitor satisfaction, which can create understanding about what types of activities people are interested in and the quality of their experiences. NVUM data provide the most relevant, reliable, and accurate data available on national forest visitation. NVUM data are collected using a random sampling method that yields statistically valid results at the national forest level. As a rule, NVUM results are unbiased. The sampling plan takes into account both the spatial and seasonal spread of visitation patterns across the forest. However, results for any single year or season may under or over-represent some groups of visitors.

The Inyo NF offers a full suite of outdoor recreation activities, in all seasons, for those who enjoy either motorized or non-motorized pursuits on land, water, or in the air. The list of recreation activities is long, and includes cross-country and downhill skiing or snowboarding, snowmobiling, rock or ice climbing and mountaineering, hiking or backpacking, equestrian riding or packing, mountain biking, camping, hunting or fishing, off-highway vehicle (OHV) driving or riding, picnicking, swimming, boating, paddle boarding, hang-gliding, wildlife watching, fall foliage viewing, visiting historic sites or scenic areas, participating in interpretive programs or tours, resort use, and more.

The top ten most popular activities in terms of visitor participation on the Inyo NF stayed relatively constant between 2006 and 2011, though rankings have changed over time. They include:

- Viewing Natural Features
- Relaxing
- Downhill Skiing
- Hiking/Walking
- Viewing Wildlife
- Driving for Pleasure
- Nature Center Activities
- Developed Camping
- Picnicking (in 2011)
- Resort Use (in 2011)
- Fishing (in 2006)
- Visiting Historic Sites (in 2006)

Viewing natural features, relaxing, hiking/walking, downhill skiing, and viewing wildlife have consistently remained the top five most popular activities. Viewing natural features had the highest percentage of participation in both 2006 (49.9 percent) and 2011 (59.2 percent). Day use developed sites are used by almost all visitors who come to the Inyo NF. The use of overnight developed sites and designated wilderness areas has greatly increased between 2006 and 2011.

Overall visitor satisfaction on the Inyo NF is very high. Almost 90 percent of visitors indicated that they were very satisfied with their visits in 2011. Visitors were generally satisfied with the services, access, facilities, and sense of safety at developed sites, undeveloped areas, and in wilderness areas. Visitors did not feel that overcrowding was an issue. The only categories that showed a decline in visitor satisfaction between 2006 and 2011 were facilities and services in undeveloped areas. Visitors generally feel a moderate level of crowding for all site types.

Despite the many activities currently available on the Inyo NF, and the high degree of satisfaction expressed by visitors, there is nonetheless desire for additional recreation opportunities on the forest.

Emerging or Unique Recreation

The increasingly urban population is pursuing more challenging outdoor adventures (Sheffield 2012). Though not reflected in the NVUM survey results above, local recreationists highlighted the importance of particular recreation opportunities during public involvement processes.

Rock climbing and mountaineering are popular recreation activities on the Inyo NF. Some people expressed concerns regarding intensive use of the Buttermilks area and resource impacts associated with dispersed camping and climbing. There is a desire for developed site facilities, such as a restroom, to be constructed in the Buttermilks where this high use is prompting sanitation concerns. Riders who participate in the relatively new recreation activity of "fat biking" or "snow biking" would like to use groomed snow trails on the forest (Shirk 2013). Currently, the use of wheeled vehicles is prohibited on groomed snow trails by Forest Order No. 04-92-11. Private pilots have expressed interest in using airstrips on the Inyo NF, along with airplane camping and other associated recreation activities (Recreation Aviation Foundation 2012). Stakeholders also highlighted a demand for additional outfitter and guide services authorized under special use permits, particularly for those services not currently available, such as guided interpretive day hikes in the wilderness.

Compatibility Issues and User Conflict

Increasing population growth and demand for recreation opportunities may lead to more crowding and conflict among forest users. The variety of recreation activities that people are interested in is expected to continue to grow, potentially competing with existing uses (California State Parks 2005, Cordell 1999). Despite the many options currently available for recreation access on the forest, there is a desire for more. Local groups have expressed interest in expanding non-motorized recreation opportunities, while there is also interest in additional opportunities for motorized access to the forest.

Places like Reds Meadow Valley, Mammoth Lakes Basin, upper Rock Creek, Bishop Creek, and the Whitney Portal see a large number of visitors each year, and demand for recreation in these areas continues to increase. With the demand for more recreation in these areas, there will be a need to consider strategies that effectively minimizes crowding or conflicts between competing uses while still preserving visitor experiences.

Social, Cultural, and Economic Conditions

The Inyo NF is beloved by visitors and eastern Sierra Nevada residents for the spectacular scenery and world-class recreation opportunities available. People come from all over the United States and the world to experience the grandeur of this landscape and high quality recreation that the forest offers. In 2011, the

Inyo NF had the second highest number of visits across the ten forests in the Sierra Nevada bio-region. According to NVUM data, annual visitation decreased from an estimate of 2.86 million people in 2006 to 2.53 million in 2011. This table lists the distance travelled by visitors to the forest.

Distance traveled by visitors to the Inyo NF

Distance travelled from home	Percent total visits to the Inyo NF 2006	Percent total visits to the Inyo NF 2011
0 - 25 miles	16.4	9.0
26 - 50 miles	2.5	3.0
51 - 75 miles	1.1	2.3
76 - 100 miles	0.8	0.8
101 - 200 miles	8.0	6.7
201 - 500 miles	62.9	61.7
Over 500 miles	8.3	16.5
Total	100.0	100.0

Foreign visitation increased between 2006 and 2011. Multi-national forest users often have different expectations for their recreation experiences than those of the traditional forest user, and can provide a challenge in effective communications (Cordell 1999).

Most visitors to the Inyo NF come from southern California. The largest proportion of NVUM survey respondents have consistently come from Los Angeles County (18.8 percent in 2011 and 20.8 percent in 2006). Future changes in the state's population will likely affect outdoor recreation more than anything else.

Population growth is expected to increase the overall demand for recreation activities, access, and services. While growth has been relatively low in the eastern Sierra Nevada compared to the rest of the bio-region and California in general (Lin and Metcalfe 2013), the population in Inyo County is projected to increase 27 percent by the year 2050 and 37 percent in Mono County (California Department of Finance 2012). Growth outside the eastern Sierra is expected to impact the Inyo NF, particularly in southern California.

California's senior cohort is one of the fastest growing segments of the population and already the largest in the United States (Roberts et al. 2009). The eastern Sierra Nevada has a larger portion of residents over the age of 60 compared to the bio-region and state as a whole. The proportion of visitors to the Inyo NF in older age classes increased between 2006 and 2011. At the same time, the proportion of visitors to the Inyo NF under the age of 16 made a substantial jump from 16.6 percent in 2006 to 30.6 percent in 2011. Baby boomers and older adults typically want more amenities and improved access, while younger adults want more immediate and lively information and access, drawn by opportunities for excitement, such as extreme sports and adventure recreation (California State Parks 2005).

No demographic trend is of greater importance to national forest managers and leaders than the immense growth of cultural diversity in the state (Roberts et al. 2009). Shifting demographics are expected to change recreation demands on national forests and may impact visitor satisfaction. The prominence of Latino and Asian values and vision is expected to increase as these two cultural groups increase in size

and influence (Roberts et al. 2009). For example, research indicates that many ethnically diverse groups prefer more developed sites that have picnic tables, grills, trash cans, and flush toilets (Roberts et al. 2009). Group facilities for both camping and day use are important to Hispanic visitors and will become even more so in the future as larger groups of family and friends want to recreate together (California State Parks 2003, 2005). What constitutes a family has changed over the years because of changing demographics. Where in the past, a family was viewed as a mother, father, and their children, today a family may be multi-generational and may or may not be related by blood or marriage (California State Parks 2005).

While many visitors to the Inyo NF are coming from culturally diverse southern California, people from culturally diverse backgrounds are still underrepresented as forest visitors. A vast majority of forest visitors are White (93.3 percent in 2011 and 2006) and non-Hispanic (89.7 percent in 2011 and 92.3 percent in 2006). Forest management can inadvertently create barriers to use and enjoyment such as language and lack of information, by the growing population of ethnic minorities in California and the United States as a whole (Roberts et al. 2009).

Environmental Conditions

Climate change is predicted to produce warmer temperatures and drier conditions influencing snowpack, drought, and hydrologic flow. As the number of frost-free days is increasing (Cordell et al. 2009) less precipitation will fall in the form of snow, particularly affecting where and when winter recreation activities occur in the future (Morris and Walls 2009). The snowpack is expected to melt earlier in the season, producing less runoff to feed rivers and streams during the summer months. Activities dependent on snow and snow melt would be affected. Warmer temperatures could cause recreationists to shift their activities to higher elevations during the summer months to escape the heat. Increased frequency of large, severe fires or areas with high insect or disease tree mortality that reduces the attractiveness of the recreation setting or renders it unsafe for visitor use could reduce the availability of desirable settings for the outdoor activities that visitors want to pursue.

Other Recreation Opportunities in the Broader Landscape

Visitors can enjoy an outstanding recreation experience as a result of the many activities available on the Inyo NF and adjoining lands. While the unique opportunity for lift-served downhill skiing or boarding is only offered on the Inyo NF in the eastern Sierra region, most other recreation activities are also available on adjoining public lands managed by other agencies. Nearby communities and private lands offer complementary recreation activities typically found in an urban setting, such as concerts, athletic club use, organized sports, arts and crafts fairs, parades, museums and much more.

These shared geographic boundaries create opportunities for maximizing use of open space across all lands. Maximum use of open space across multiple land ownerships can alleviate recreation pressure by dispersing visitor use. Conversely, a high demand for or constraints on recreation use in one area can create additional pressure on adjoining lands. Thus, shared boundaries add complexity and need for coordination between the Inyo NF and adjoining lands when managing recreation.

Government Planning

Local government planning can also influence recreation opportunities in the plan area. There are numerous local communities that have strong ties with the Inyo NF. Many have recreation plans which

describe a vision for maximizing recreation opportunities and access in collaboration with the Inyo NF. For example, numerous communities have plans in place or in progress to establish motorized and non-motorized trail networks which connect private and public lands.

Opportunities to Foster Greater Connection between People and Nature

The Inyo NF offers a variety of opportunities that connect people and nature through its recreation program. However, Americans have become increasingly disconnected from the outdoors and our natural and cultural heritage (Council on Environmental Quality et al. 2011). The nearly 80 percent of Americans who live in urban areas find it particularly difficult to connect with the outdoors, children spend less than half as much time outside as their parents did, and are "plugged in" to electronic devices for more than seven hours a day (Council on Environmental Quality et al. 2011).

Increasing understanding about the natural environment and helping more people have positive outdoor experiences can create a citizenry that understands the importance of being good stewards of the land. Conservation education and interpretation can play a key role in helping to foster greater connection between people and nature. These programs offer opportunities for experiential learning that can help improve understanding of complex resource issues. In addition, they can be effective tools for encouraging collaboration in resource management. Partnership and volunteer programs play a vital role by reaching out to a broad and diverse group of citizens and getting them involved on the Inyo NF. These programs are essential to helping the Forest Service carry out its mission, and can help citizens feel a direct and meaningful connection with the land. Opportunities for fostering connection between people and nature are especially apparent within urban communities and with traditionally under-represented groups like youth, low-income populations, and minority populations. Current recreation opportunities and communication and information approaches may be a poor fit for these communities (Winter et al. 2013).

With the trend of declining federal budgets expected to continue in the future, partnerships and partner contributions may become even more important in the future for sustaining interpretive services, conservation education, volunteer work, citizen stewardship, and special events to connect people with nature on the Inyo NF. Opportunities for developing new models for working with partners continue to be explored. However, in some cases, Forest Service policies and authorities either prevent or slow our ability to engage partners and formalize partnerships, making it more challenging to capitalize on unique opportunities or align partner and agency expectations.

Recreation Access

Recreation access is the nature, extent, and condition of trails, roads, and other transportation that connect people to recreation settings and opportunities. The Inyo NF provides access to recreation opportunities on the forest through a multitude of options, including conventional two-wheel drive roads, four-wheel drive roads, motorized trails, non-motorized trails, motorized over snow trails, and non-motorized snow trails. Access to the Inyo NF is also provided by partners, agencies that manage adjoining public lands, and private land owners. The types and conditions of roads and trails are further discussed in Chapter 11 of this assessment, along with an evaluation of needs for maintenance and budget shortfalls for completing such work.

Forest roads offer scenic views and provide direct access to trailheads, staging areas, campgrounds, and picnic facilities. The Inyo NF has approximately 2,862 miles of National Forest Transportation System (NFTS) roads, 949 miles of which are designated at a maintenance level for all passenger cars that are street legal. The remaining 1,877 miles are designated at a maintenance level recommended for high clearance, four-wheel drive vehicles. There are 1,612 miles of designated trails on the forest including 340 miles of motorized trails, 225 miles of over-snow motorized trails, 999 miles of standard non-motorized trails, and 48 miles of over snow non-motorized trails.

A portion of the motorized trails and roads began as user-created travel routes to retrieve personal use firewood, to access dispersed camping areas, or for other uses of the forest. Some of these motorized routes resulted in undesirable impacts to the land. For example, water quality was degraded in areas where road erosion occurred near streams, and cultural resources were damaged where roads traversed archeological sites. In compliance with the 2005 Travel Management Rule (36 CFR 212), the Inyo NF completed a travel management analysis and made the decision to prohibit motorized use on approximately 660 miles of unauthorized routes, and added 886 miles of roads and 157 miles of motorized trails (USFS 2009). The Inyo NF is presently relying heavily on state off-highway vehicle grant funding for maintenance of system roads and trails and rehabilitation of unauthorized routes, since funding available with the forest budget is not sufficient to complete this necessary work.

As with motorized trails and roads, the funding available within the forest budget has not been sufficient to maintain all non-motorized trails. The Inyo NF currently uses volunteers to help with trail maintenance. Local organizations have been instrumental in completing several recent volunteer trail work projects, including Friends of the Inyo, Mammoth Lakes Trails and Public Access, and Backcountry Horsemen, among others.

Partners, agencies that manage adjoining public lands, and private land owners currently provide a high degree of support in offering access to the Inyo NF and opportunities to connect open space across all land ownerships.

There will likely be an overall increase in demand for access to the Inyo NF. Preferences for the type of access may shift with changing demographics. Infrastructure maintenance will continue to be a challenge given declining federal budgets and increasing demand for additional access. The contributions of partners and volunteers in maintaining or promoting access on the forest have the potential to become even more important in the future. Future opportunities to connect open space across all land ownerships in the eastern Sierra will be important to optimize capacity for recreation and tourism in this region.

Scenic Character

Scenic character is a combination of the physical, biological, and cultural images that give an area its scenic identity and contribute to its sense of place. It provides a frame of reference from which to determine scenic attractiveness and to measure scenic integrity (36 CFR 219.19).

Scenic character is a component of the Scenery Management System (SMS), which replaced the Visual Management System (VMS) in 1995. VMS was used to inventory, analyze, and monitor forest scenery resources in the LRMP under the 1982 Planning Rule. Scenic character descriptions identify the existing and potential valued scenic attributes, including landform, vegetation, water bodies, cultural, and historic features. Scenery on the Inyo NF has only been described using the VMS for the 1988 LRMP process. However, the VMS framework was correlated with the newer SMS framework to assess scenic character.

The Inyo NF has six different scenic character groups that are based on vegetation assessment types identified from the forest's Terrestrial Ecological Unit Inventory. They include the following:

High Peaks: represent ecosystems found in alpine settings, such as the crest of the Sierra Nevada and White Mountain ranges; are typically found in wilderness, forming the dramatic scenic backdrop of rugged mountains which dominate the view from many areas of the forest.

High Forests: represent subalpine ecosystems, such as Bristlecone or whitebark pine forests; invite visitors to wonder at the ancient and gnarled trees which survive where frequent winds and winter snows create an inhospitable environment for life.

Mid-Elevation Forests: encompass Jeffrey pine and mixed conifer ecosystems; offer shade and shelter in summer and are places where people like to camp, picnic, and go for scenic drives.

Pinyon Woodlands: represent areas with pinyon pines; are culturally valued as a source of pine nuts for food.

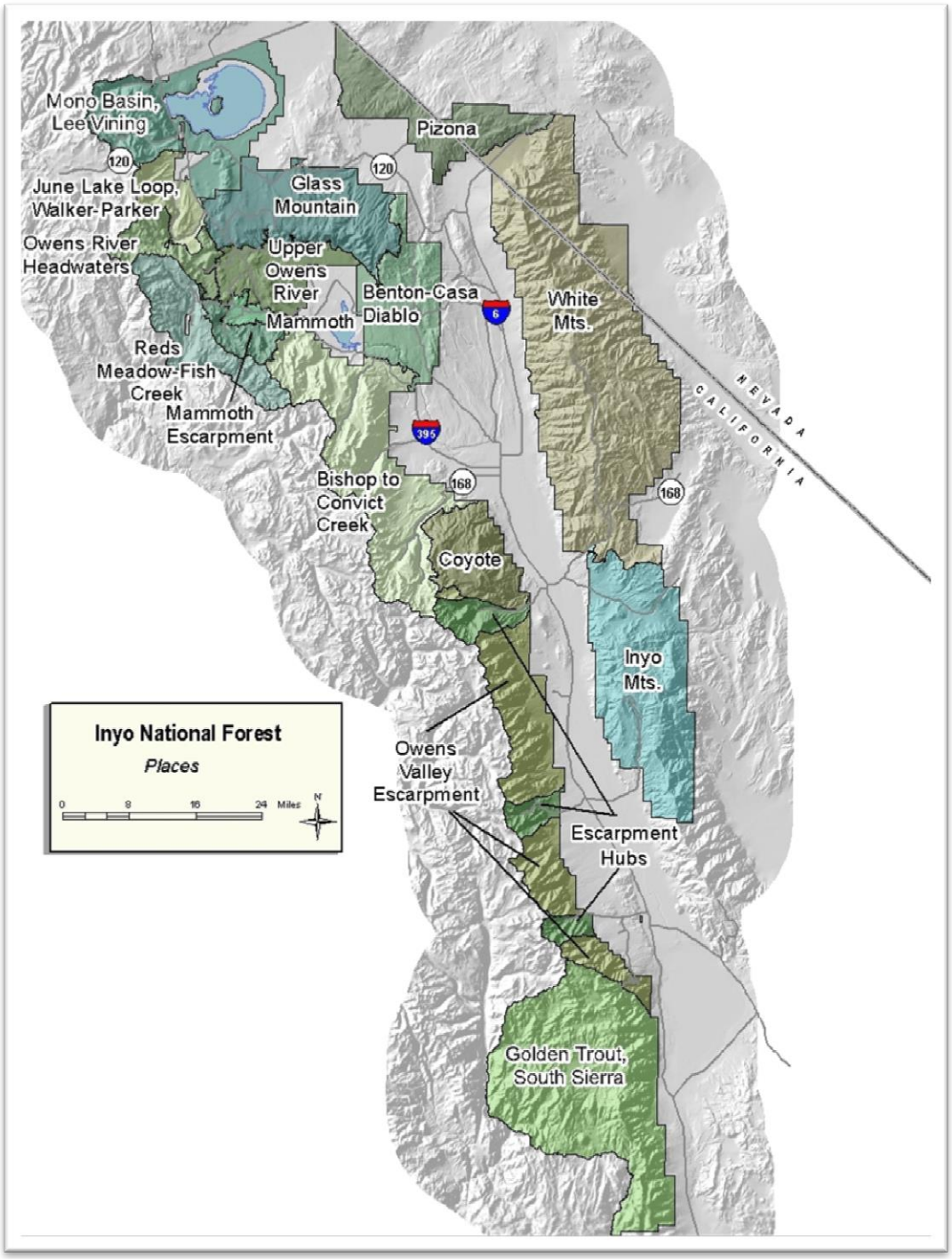
Shrublands: represent sagebrush and blackbrush ecosystems; are characterized by wide-open vistas, creating a sense of being able to see forever.

Distinctive: includes unique and important ecosystems that occur on relatively few acres, such as aspen, meadows, riparian areas, black oak, and lakes; includes special areas, which draw visitors to view spectacular fall colors or laze by the lake on a summer day.

The Inyo NF is divided into 16 unique "places" that were identified based on the unique scenery offered, how people interpret and associate with the landscape, and the 1988 LRMP. These are displayed in the map below. The ecological context provides the foundation for describing and evaluating scenic character, which is assessed by looking at scenic integrity and scenic stability.

Scenic integrity measures the degree to which a landscape is free from visible disturbances that detract from the natural or socially valued appearance, including any visible disturbances from human activities or extreme natural events outside of the natural range of variability (NRV). Scenic integrity uses a graduated scale of six levels ranging from very high integrity to no integrity. The VMS used existing visual condition (EVC) to describe the degree of deviation from the natural appearing landscape. Based on EVC information from the 1988 LRMP Environmental Impact Statement, nearly 85 percent of the Inyo NF was considered Type 1 (untouched) or Type II (changes unnoticed). These landscapes include wilderness areas and areas within the primitive non-motorized and semi-primitive non-motorized ROS classes, and are expected to have high to very high scenic integrity. The most common developments on the Inyo NF that alter scenic integrity include power lines, communication sites, substations, propane tank storage, geothermal development, ski areas, hydropower facilities, human-made lakes, recreation facilities, resorts, and ephemeral conditions like dust and smoke.

Future trends that have the potential to affect scenic integrity on the Inyo NF include power line development and replacement, geothermal and alternative energy development, and episodic smoke and dust events. Future developments are uncertain at this time as is the degree and where they will be located.



Map of Inyo NF places

Scenic stability measures the degree to which the valued scenic character and its scenery attributes can be sustained through time and ecological progression. In other words, it looks at the ecological sustainability of the valued scenic character and its scenery attributes. Because attributes such as rock outcroppings and landforms change relatively little over time, scenic stability focuses on the dominant vegetation scenery

attributes. On the Inyo NF, many of the valued vegetation scenery attributes are at high risk of being impaired or seriously threatened due to dense vegetation conditions and encroachment, ecosystem stressors such as insect and disease outbreaks, and fire return interval conditions that render landscapes susceptible to severe wildfire, to name a few. Forest landscapes characterized by these conditions are considered to have low scenic stability. The natural range of variation (NRV) can be used to assess the scenic stability of forest landscapes. This can be measured in terms of the landscape's departure from NRV. Insufficient fire or too much fire on the landscape can determine the level of departure from the NRV. Departures in fire regime, insect outbreaks, and other disturbances from the NRV also help assess scenic stability. Descriptions of ecological conditions and departure from NRV can be found in Chapters 1 and 3 of this assessment.

Trends that have the potential to affect scenic stability on the Inyo NF include increasing insect and disease outbreaks, dense vegetative conditions that increase the risk of severe wildfire, the departure of fire frequency or severity from the natural range of variability within the shrubland settings, and conifer encroachment on aspen stands. Dense vegetation can also diminish scenic beauty (Ryan 2005).

Extent to Which the Plan Area Meets Recreation Demand and Sustainability of Recreation

Sustainable recreation is the set of recreation settings and opportunities on National Forest System (NFS) lands that are ecologically, economically, and socially sustainable for present and future generations (36 CFR 219.19). To be sustainable, the set of recreational settings and opportunities must be within the fiscal capability of the planning unit, be designed to address potential user conflicts among recreationists, and be compatible with other plan components including those that provide for ecological sustainability. While the Inyo NF currently provides for a broad range of developed and dispersed recreation opportunities and has maintained its scenery resource, challenges still exist related to the sustainability of recreation on the forest.

The trend for a declining federal budget constrains many aspects of land and resource management, and the ability to meet demands for recreation opportunities and access. The agency has fewer personnel to manage recreation services and less capital to maintain or construct recreation infrastructure. Many facilities at developed sites are in a deteriorated condition and in need of substantial capital investment for repair and maintenance. Available funding has not been sufficient to address this need for capital investment. See Chapter 11 of this assessment for more information about conditions at recreation facilities. This is especially critical given increasing recreational uses of the Inyo NF and greater diversity in public expectations for recreation management. Partnerships and new management strategies have played an increasing role in maintaining and improving developed recreation facilities and trails on the Inyo NF and will be critical to meeting recreation demand in the future. The level of facilities and programs currently available to the public are dependent on these partnerships.

Under the existing plan and current management paradigm, the management of resources is typically reactionary to the influences of recreation uses and evolving public expectations for recreation management. Thus, management is often "behind the curve" and trying to catch up with new demands for recreation use and potential for resource impacts as a result of unmanaged uses.

Unmanaged recreation can negatively impact ecosystem health, for example, through the spread of invasive species, overfishing, and degradation of water quality. Examples of unmanaged recreation include development of rock climbing routes at newly discovered crags, user-created mountain bike trails,

and wilderness or dispersed camping in sensitive ecosystems such as stream zones, motorized vehicle use outside of authorized travel routes. Unmanaged recreation can also adversely affect visitor experience as a result of conflicting or competing uses and overcrowding. Ecosystem impacts may ultimately have a reciprocal effect on recreation if impacts on the land create conditions where recreation use can no longer be supported.

To meet sustainable recreation goals in the future, adaptive management will be essential. This is particularly true for unmanaged recreation, where timely response to new uses that have potential ecological effects will be necessary. Given the expected increase in recreation demand, tradeoffs will need to be made to ensure the Inyo NF's resources are managed sustainably.

Conservation and resource stewardship have become and will continue to be an important component of sustainable recreation, especially for more environmentally sensitive areas. It is generally through recreation that visitors interact with and learn about the Inyo NF. Effective interpretive techniques and public information services can help to inform and motivate the public into becoming stewards of the forest (California State Parks 2002, NARRP 2009).

There are other influences beyond the control of management that impact the sustainability of recreation and scenery resources on the forest. For example, climate change may negatively impact winter recreation opportunities because of reductions in snowfall or season length. Air pollution from outside sources and loss of vegetation from wildfire can degrade scenic quality. A downturn in the regional or national economy can cause a decline in visitation and tourism.

Contribution the Plan Area Makes to Ecological, Social, or Economic Sustainability

Recreation on the Inyo NF contributes to social sustainability by providing opportunities for people to connect to the land. This in turn, contributes to community wellbeing and helps people develop a stewardship ethic that can further protect the land and contribute to ecological sustainability.

The places that people visit often have emotional meaning that can help define sense of self, as well as social identity. Outdoor recreation also contributes to human health and wellbeing by offering a variety of physical and mental health benefits. Eighty-four percent of the Californians polled in the most recent Comprehensive Outdoor Recreation Plan (CORP) statewide survey said outdoor recreation was an "important" or "very important" contributor to their quality of life (Roberts et al. 2009). Recreation, among other activities, on the Inyo NF continues to tie Native Americans to special places that have traditionally been used by their people. The forest also helps visitors make connections with their heritage through its cultural and historical resources. Recreation opportunities on the forest promote social interactions. Being with friends and family is an important reason people recreate on national forests, and plays an especially large role for certain groups, like the growing Latino population.

The Inyo NF draws numerous visitors to the eastern Sierra Nevada, supporting a strong tourism industry that contributes to the economic vigor of local businesses and communities. Public lands can play a role in stimulating local employment by providing opportunities for recreation. Communities adjacent to public lands can benefit economically from visitors who spend money in the travel and tourism sector in hotels and restaurants, as well as resorts, gift shops, and elsewhere. In 2010, these travel and tourism industries comprised 49 percent of jobs in the counties bordering the Inyo NF (U.S. Department of Commerce 2012). Travel and tourism is an important sector to economies in Mono County (48.6 percent

of employment and 32.2 percent of earnings) and Inyo County (23.5 percent of employment and 11.5 percent of earnings) (Dean Runyan and Associates 2012). Recreational activities on the Inyo NF specifically provide a significant contribution to the local economy generating 12.5 percent of all local jobs and over nine percent of all local labor income in 2008 (USFS 2008).These counties also receive revenue from sales tax on temporary lodging from visitors who come to recreate on the forest and other areas. This transient lodging tax accounts for 4.6 percent of tax revenue in Mono County and 4.3 percent in Inyo County, contributions that are much higher than the average for the Sierra Nevada (California State Controller's Office 2012).

Information Gaps

Sustainable recreation is a relatively recent concept for the Forest Service. As such, there is little existing information that examines this topic. Dispersed recreation may be of concern in specific areas. However, it is very difficult to quantify the effects of dispersed recreation on the landscape and there is a data gap on where impacts related to dispersed recreation is occurring. Generally, the effects of use at each individual location are small, but the cumulative impact to ecological integrity is unknown. While partners are known for providing valuable recreation activities and services on Inyo NF, data to fully characterize all partner contributions are limited. Finally, the Inyo NF does not currently have an SMS inventory for the forest.

Chapter 10: Energy and Minerals

Important Information Evaluated in this Phase

This chapter is a summary of the Inyo NF Chapter 10 topic paper. Two sets of data were used for this assessment of renewable and nonrenewable energy resources: a report assessing the potential for renewable energy on National Forest System lands (US Department of Energy 2005); and the Renewable Energy Atlas of the United States (Argonne National Laboratory 2012). Information used to conduct the assessment of mineral resources includes public documents and data produced by federal and state agencies, internal Inyo NF documents and studies, peer-reviewed scientific literature, company profile websites, U.S. Geologic Survey Maps, federal regulations, Forest Service manual direction, and personal communication with professionals considered to be knowledgeable in their respective fields. Mileage figures presented here are slightly different than those presented in Chapter 9 due to the use of different data sources for the information.

Nature, Extent, and Role of Existing Conditions and Future Trends

Hydropower

The Inyo NF has a commercial value to the people of California resulting from hydroelectric development projects on four streams (watersheds) on the forest. These facilities are operated by Southern California Edison and are authorized under a Federal Energy Regulatory Commission (FERC) license. All four facilities were relicensed during 1994 through 1999 for a term of 30 years. There are other, smaller-scale hydropower projects located on the forest that are exempt from FERC licensing. These small hydropower projects are permitted by a special use authorization.

Many of the watersheds suitable for major hydropower development on the Inyo NF have already been developed. The exception to this is Pine Creek Canyon, located approximately ten miles northwest of Bishop Creek. Several preliminary permits have been filed to study the potential for hydropower development in this area. The Inyo NF has considerable potential for small hydroelectric power generation and future development will depend on cost effectiveness when all resources are considered.

Transmission Corridors for Energy Development

The Inyo NF currently has approximately 50 miles of existing high voltage transmission lines that deliver energy from hydro and geothermal facilities located on National Forest System (NFS) lands to high demand centers, such as populated areas. These transmission lines are under a Forest Service easement to and maintained by Southern California Edison. Much of the existing infrastructure is aging, and requires frequent repair and maintenance. Future development of any renewable energy facilities on the forest would most likely require new transmission lines to tie into existing lines.

Wind Energy

There are no permitted wind power facilities or testing sites approved on the Inyo NF. According to a 2005 report, the forest has a maximum wind energy development potential of 7,621 acres and 154 megawatts, and is not identified as a high-potential area for wind energy (U.S. Department of Energy 2005).

Biomass

The 62,000 acre Mammoth Lakes – June Lake core timber management area is the most likely source area for biomass material in the eastern Sierra Nevada. Other potential sources for biomass material include Inyo NF woodlands, lands managed by other agencies such as the Bureau of Land Management (BLM) and the Los Angeles Department of Water and Power (LADWP), and private lands largely associated with the communities of Mammoth Lakes and June Lake. The extent to which these sources might contribute to a supply of biomass material is unknown at this time. In addition, no biomass power is currently being produced on the forest. Preliminary findings from a feasibility study contracted by Mono County indicated a thermal energy-type facility would be feasible in the Mammoth Lakes area.

Geothermal Energy

Seven geothermal leases currently exist on the Inyo NF. Two of these leases were issued in 1981 and the other five were issued in 1984. The leases are located north and east of the Town of Mammoth Lakes. Total area for the seven leases is approximately 13,430 acres (Ormat 2013). Potential for future geothermal exploration includes drilling of exploration wells and geophysical testing. Electricity from geothermal resources is produced from a geothermal facility on the forest and two other facilities located on private lands, approximately three miles east of the town of Mammoth Lakes. The total potential electricity production from currently proposed facilities would be 81.8 megawatts compared to the current 40 megawatts from existing facilities.

Solar Energy

There are no permitted solar power facilities currently approved on the Inyo NF but the forest has a high potential for solar development (U.S. Department of Energy 2005). Constraints that could possibly affect future solar energy production proposals include conflicts with current visual quality objectives, inventoried roadless areas, and other resource concerns.

Mining

Active mining claims are present within the Inyo NF and include lode, placer, and mill site claims. Groupings of mining claims are found in the areas of Mazourka Canyon, Pine Creek, Mammoth Lakes Basin, Little Hot Creek, Black Point, Truman Meadows, and Sugarloaf. Active mining claims are also scattered along the lower elevations of the west side of the White Mountains in California and east side in Nevada, the western slopes of the Inyo Mountains, and the eastern slopes of the Sierra Nevada near Big Pine and north to Lee Vining (LR2000, 2013). Current mining activity generally consists of exploration, production, and milling activities and exploration is active in the Mammoth Lakes Basin, Truman Meadows, and Mazourka Canyon.

Mining activity on the Inyo NF is likely to continue based on existing and past exploration, production, and milling activities in the area. Prospecting activities may lead to exploration activities if a discovery of a valuable mineral is made. Exploration activities may lead to additional exploration or production. Production activities are likely to continue as long as viable resources exist, but may cease if resources are exhausted. Future mining activities are most likely to occur in areas where mining claims exist or past mining activities have proven economical. Other factors influencing future activity include changes in management of certain areas such as new listing of federally threatened or endangered species, wilderness designation, or county and state policies affecting use.

Common Variety Minerals

The area of the Inyo NF that is currently open to mineral entry includes roughly 48 percent of the total administered area. In the broader landscape, certain types of mineral materials are present on private, state, and federally managed lands and may be readily available from private commercial entities. These materials include but are not limited to sand, gravel, cinders, pumice, perlite (APC 2013), talc, kaolinite, sulfur, and certain landscape rock. In the broader landscape, materials such as sand and gravel, which are commonly used as fill in construction, are readily available in valleys, on low angle slopes, and drainages. These environmental settings are abundant on state and BLM-managed lands in the broader landscape and are common sources for mineral material use by private, agency, and commercial entities. Landscape rock and other materials are commonly found on steeper slopes, in outcrops, or certain geologic formations.

Abandoned Mine Lands

Abandoned mine sites are present throughout the broader landscape, and tend to be found in higher concentrations in the White Mountains, Inyo Mountains, and areas of the Sierra Nevada with rock types associated with mineralization. The approximate locations of abandoned mines are indicated by mine symbols on U.S. Geological Survey topographic maps. Over 5,000 mine symbols are present on topographic maps on the broader landscape, with 1,500 of those mine symbols on the Inyo NF. There are

several known abandoned mine sites on the forest that contain hazardous substances in quantities or concentrations considered hazardous to human health.

Contributions the Plan Area Makes to Ecological, Social, or Economic Sustainability

The Inyo NF supports the development of power through hydropower generation that meets social and economic demands. Electricity has fueled countless technological advances, and provides the public more food, deeper mines, stronger metals, modern medicines, and bigger cities. There would be no way to support modern society without electrical power, especially given projected population growth.

Hydropower offers numerous advantages over alternative fuels. Hydropower is:

- Renewable -- the earth provides a continual supply of water from rainfall and snowmelt
- Efficient -- hydropower plants convert about 90 percent of the energy of falling water into electricity
- Clean -- hydropower plants do not emit waste heat and gases
- Reliable -- hydropower machinery is relatively simple, reliable and durable
- Flexible -- units can start up quickly and adjust rapidly to changes in demand

Inyo NF hydropower plants play a key role in the economy by offering an affordable power source, which helps keep overall energy prices down. Without hydropower, the country would have to burn more coal, oil, and natural gas. The increasing availability of hydropower also helps reduce California's dependence on other nations for fuel (Army Corp of Engineers 2009).

Current levels of hydropower generation on the Inyo NF appear to be economically or socially sustainable, although climate change may alter precipitation regimes which may, in turn, affect power generation.

Forest wind and solar production is another potential source of energy to meet the growing demand from an increasing population. Current energy production projections from wind will likely be limited and not on a scale that could support increasing population. Solar power has greater potential on the forest but uncertainties about the economics of these facilities and potential conflicts with other forest resources make it difficult to predict future development.

The Inyo NF, in accordance with mining laws and regulations, provides for mineral development which supports economic and social needs. Without minerals, the public would not have electricity, food or shelter. Minerals make today’s technology-based life possible. The public wants the benefits from those minerals, but some would prefer mining to occur outside their area of interest. The Inyo NF has trained mineral administrators who respond to Notices of Intent and Plans of Operation, and issue permits and contracts for minerals materials. These processes allow the forest to work with mining applicants to make sure the mining is done in a sustainable way.

Information Gaps

Known information gaps with respect to mineral resources include but are not limited to, locations of unknown abandoned mine sites with potential public health and safety hazards, ongoing changes in recordation of mining claims, mining activities on the Inyo NF, which occur without the knowledge of the

Forest Service, up to date mineral material reserves inventory, and geologic hazards that have not been documented or inventoried.

Chapter 11: Infrastructure

Important Information Evaluated in this Phase

Infrastructure is considered the built property created to support the use of National Forest System (NFS) lands. The six major categories of infrastructure on the Inyo NF are transportation, administrative facilities, recreation facilities, public utilities, privately owned facilities sited on the forest, and range infrastructure. This chapter examines infrastructure conditions and trends that may affect the condition or development of plan area infrastructure. This chapter summarizes information from the Inyo NF Chapter 11 topic paper.

Nature, Extent, and Role of Existing Conditions and Future Trends

Transportation

The transportation system for the Inyo NF is defined as "the system of National Forest System roads, National Forest System trails, and airfields on NFS lands" (36 CFR 212.1).

NFS roads are assigned a maintenance level (ML) between 1 and 5, which defines the level of service provided by and the maintenance required for a specific road. Currently, the Inyo NF manages 1,985 miles of roads, with the following maintenance levels:

- **Level 1 (less than one mile):** These roads are intermittently closed to vehicular traffic for a year or more. Basic maintenance is performed to prevent resource damage and to retain the option of future use. They are closed to vehicles, but may be available for non-motorized uses.
- **Level 2 (1,858 miles):** These roads are open to high clearance vehicles, both highway and non-highway legal vehicles. They are not maintained for passenger car traffic or user comfort and convenience. There are no warning or traffic signs.
- **Level 3 (65 miles), 4 (37 miles), and 5 (25 miles):** These roads are open to standard passenger cars. Warning and traffic signs are used. The differences between levels are not distinct. Higher levels generally mean a higher degree of user comfort, higher speeds, and more structural improvements. Non-highway legal vehicles are not permitted on these roads, aside from portions of Glass Creek and Sawmill Cutoff roads.

Most of these roads are located within the Inyo NF's administrative boundary. Thirty-three miles are located outside the boundary. Fifty miles are administrative roads and are closed to public access. These are mostly ML 2 roads.

The condition of ML 2 roads is assessed every five years according to standards set by the California State Off-Highway Motorized Vehicle Recreation (OHMVR) Division. This monitoring is required to receive state off-highway vehicle (OHV) funding. To date, 50 percent of ML 2 roads have been surveyed. Of those surveyed, 64 percent are considered to be in good condition, 21 percent in moderate condition, ten percent in poor condition, and five percent were found to be nonexistent.

Formal condition surveys for ML 3-5 roads have not been performed, though a general assessment is presented here based on forest expertise. Of the total 127 miles, 54 percent are paved, 19 percent are surface with aggregate materials, and 27 percent have a native surface. The aggregate and native surface roads require minimal routine maintenance and could generally be classified as being in good to moderate condition. With a few exceptions, paved roads could generally be classified as being in moderate to poor condition. Many contain numerous potholes, freeze-thaw cracking, heaving, and raveling at the edges. Roads have the potential to impact various resources managed on the forest, especially if poorly located or improperly maintained. Roads can cause habitat fragmentation, create barriers to aquatic species movement, and increase the spread of invasive species. Roads can impact water quality by concentrating runoff and contributing flow directly to a natural water body. See Chapters 1, 2, and 5 of this assessment for more information about the impacts of roads on aquatic ecosystems, water quality, and aquatic organisms.

Watersheds on the Inyo NF with the highest road density are generally located between Mono Lake and Mammoth Lakes and immediately surrounding Tom's Place. Watersheds with moderate road density are located around Mono Lake, between Mammoth Lakes and Tom's Place, east of Highway 395 between Bishop and Lone Pine, west of Bishop next to State Route 168, and north of Benton.

The condition of bridges on the Inyo NF impacts public safety as well. The Inyo NF currently has 20 road bridges under its jurisdiction. All are open to traffic and currently rated with all major components in satisfactory condition or better.

In addition to NFS roads, the Inyo NF contains 1,445 miles of roads falling under other jurisdictions that have the potential to impact resources on the forest.

Breakdown of roads on the Inyo NF under other jurisdiction

Road Management Agency	Miles
County	721
Local[1]	133
Other federal[2]	204
State highway	150
U.S. highway	237

[1]Includes Los Angeles Dept. of Water and Power (LADWP) roads

[2]Includes Bureau of Land Management (BLM) roads

Operation and maintenance of county roads is conducted by county road crews, and has, in some cases, resulted in resource or liability concerns. Limited legal documentation exists that places these roads officially under the jurisdiction of the county. Because these roads are not classified as forest roads, the Inyo NF cannot spend appropriated dollars on their maintenance. This situation also applies to other entities, but their roads account for a much smaller percentage of the transportation system.

The NFS trail system has many different types of trails that support a variety of uses, including motorized travel, hiking, bicycling, equestrians, snowmobiles, and cross-country-skiing. The table below lists the miles of existing trails on the forest by designed use and trail class. The designed use of a trail indicates

that use which requires the most demanding design, construction, and maintenance parameters, and may not be the primary use of the trail. Trail class is the prescribed scale of development for a trail and ranges from minimally developed (trail class 1) to fully developed (trail class 5).

Trail uses and classes

Designed Use	Trail Class					
	1	2	3	4	5	Total
4-wheel drive vehicle >50”		280.2				280.2
All-terrain vehicle		25.9				25.9
Motorcycle		25.6				25.6
Bicycle			16.3	2.6		18.9
Hiker	53.6	12.9	14.4	18.5	1.3	100.6
Livestock	7.6	55.7				63.2
Pack and saddle	53.4	327.3	474.8	0.9	0.2	856.7
Snowmobile		6.1	11.2	208.6		225.8
Cross-county ski		15.2	6.0	13.4		34.6
Total	114.6	748.7	522.6	244.1	1.5	1631.4

Based on 2012 trails accomplishment reporting, 66.3 percent of existing trails on the Inyo NF met standards for their designed use and trail class. The forest has 73 trailheads that provide access to trails, the majority of which have a low level of development.

The Inyo NF has five historic airstrips located at Airport Sandflat, Coyote Flat, Templeton Meadow, Tunnel Meadow, and Monache Meadow. All five are closed, though Coyote Flat is still used by private pilots on occasion. The Inyo NF has four helipads, which are paved surfaces built for helicopter landings. An additional 30 helispots, which are not paved, are on the forest. The Inyo NF also leases two additional aviation facilities to support firefighting and search and rescue.

The overarching trend affecting the transportation system on the Inyo NF is declining budgets for repairs and maintenance. This trend is expected to continue, while national requirements for planning and maintenance continue to increase. Consequently the forest is increasingly reliant on outside funding, partners, and volunteers to manage and maintain the transportation system.

The current base funding level for appropriated road construction and maintenance funds is $545,000, which is expected to remain flat or decrease. An estimated $1.7 million would be needed annually to maintain the Inyo NF’s road system to standard. Due to the annual shortfall in road maintenance dollars, the deferred maintenance backlog increases each year. In 2009, an estimated backlog of about $26.9 million existed for the Inyo NF road system (USFS 2009). In addition, because of the annual nature of federal budgets, the forest is unable to plan for and accomplish larger-scale projects, such as road resurfacing or bridge replacement. Competitive funds for such projects are largely unpredictable.

At the same time, safety standards and resource protection guidelines have become more stringent. Warning and regulatory signs placed on ML 3-5 roads are now required to meet higher and more expensive standards. These new standards require monitoring, and new engineering studies would also be

needed, which further increases costs. New guidance on road maintenance and reconstruction to protect water quality also comes at an increased cost.

Because public safety is a priority, most road maintenance funding is used on roads open to passenger cars. Almost no ML 2 roads are maintained with appropriated dollars. The Inyo NF has had to turn to other funding sources, including state OHV funding. Little routine maintenance is currently being performed on the forest with the exception of a few high-use roads. Other road maintenance is generally limited to emergency repairs to address safety issues or critical resource damage.

Funding for trails was relatively high in the late 1980s and early 1990s but has since been reduced dramatically. The current base funding level for appropriated trail construction and maintenance funds is $115,000, which is expected to remain flat or decrease. An estimated $1.1 million would be needed annually to maintain the forest's trail system to standard. Due to the annual shortfall in trail maintenance dollars needed, the deferred maintenance backlog increases each year. The current backlog is about $16.5 million. Funding for larger-scale trails projects is also subject to competition and largely unpredictable.

At the same time, increasing and changing use of trails is causing more damage to motorized trails, resulting in greater costs to keep trails stable. Motorized users are increasingly using larger vehicles and more trails are being used by motorcycles, resulting in the need for heavier and more costly equipment to maintain these motorized trails.

The Inyo NF has increasingly relied on competitive grants from California state trust funds awarded by the California State Off-Highway Motorized Vehicle Recreation (OHMVR) Division to maintain motorized trails, and volunteers to maintain both motorized and non-motorized trails. Trails that provide primary access to high use destinations have been designed at a higher standard are maintained relatively frequently by Forest Service or volunteer staff. These trails are costly to reconstruct and maintain. Less used trails typically receive less frequent maintenance and repairs, and have more deferred maintenance needs. While these trails are more difficult to travel, they can still meet standard as long as they provide the intended access and are not causing unacceptable resource damage.

Significant infrastructure investments have been made in areas of the forest such as the Lakes Basin area of Mammoth Lakes, resulting in high-speed, high-use roads and bicycle paths. Additional grants have been obtained by Mammoth Lakes that may lead to additional high-use infrastructure being constructed in this area. Due to current budget limitations and expected decreases in funding, the agency may not be able to commit to additional operation and maintenance costs without identifying an appropriate tradeoff.

The Inyo NF is currently in the process of completing analyses that could inform plan revision, including the Travel Analysis Process required by Subpart A of the National Travel Management Rule, as well as alternative transportation feasibility studies.

Climate change can influence the transportation system due to increased flooding, which could result in additional transportation restrictions as a result of landslides and slope failures. Conversely, less snow on roads from climate change may result in increased winter season accessibility. However, it is expected that more frequent loss of access to parts of the forest would be faced with increased climate variability (Duvair et al. 2002).

Administrative Facilities

Administrative facilities are buildings and other infrastructure to support the employees, equipment and activities necessary for the management of the Inyo NF. They include: office buildings, visitor centers, fire stations, fire lookouts, warehouses, communications buildings, other utility buildings, living quarters, and wastewater systems supporting these facilities.

The Facilities Condition Rating (FCR) is used as the indicator of administrative facility condition. However, FCRs do not exist for every building. Also, condition surveys of buildings are not performed on a regular basis due to lack of staffing. Therefore, some FCRs may not accurately reflect current conditions. The FCRs presented in this document generally overestimate facility condition, i.e., the ratings indicate facilities are in better condition than they actually are. Building age is also not available for every building on the forest.

The Inyo NF Supervisor's Office is centrally located in Bishop, California. It is a leased facility that is shared with the Bishop Field Office of the Bureau of Land Management (BLM). The Inyo NF has four administrative ranger districts. The northern ranger districts, Mono Lake and Mammoth, are managed together as the North Zone. The southern ranger districts, White Mountain and Mount Whitney, are managed together as the South Zone. Some of the administrative facilities on the districts also provide office space to other governmental agencies and interpretive associations through a variety of agreements, but the facilities are owned by and primarily serve the Forest Service.

Mono Lake Ranger District: The current ranger station for this northern most district was constructed in 1961 and is located near Lee Vining. Administrative sites include: the Lee Vining compound (ranger station, work center, fire station, and employee housing), the Crestview Fire Station (includes seasonal employee housing), Gull Lake Fire Station, an active fire lookout on Bald Mountain, various cabins outside designated administrative sites, and the Mono Basin National Forest Scenic Area Visitor Center (SAVC). The majority of buildings are older than 45 years. Twenty-three percent of the facilities are in good condition. Half of the facilities on this district are in poor condition, including most of the barracks, all of the offices, half of the residences, two service facilities, and half of the storage facilities. Forest Service -owned water systems serve the Lee Vining Compound and Crestview Fire Station. The Gull Lake Fire Station and Mono Basin SAVC are served by municipal water systems. Forest Service-owned septic systems support the Lee Vining Compound and the Mono Basin SAVC. The other administrative sites are generally served by municipal sewer systems.

Mammoth Ranger District: The current Mammoth Ranger Station was constructed in 1969 in the resort town of Mammoth Lakes. Administrative sites include: the Mammoth Compound (ranger station, work center, fire station, Mammoth Welcome Center, and employee housing), the Mammoth Lakes Tack Room (tack facilities and corrals), and other residences, cabins, and utility buildings outside primary administrative sites. The majority of buildings are older than 45 years. Forty-three percent of buildings are in good condition. Twenty-two percent are in poor condition, including half of the residences and one storage facility. The primary administrative sites are served by municipal water and wastewater systems. A Forest Service-owned and operated wastewater treatment plant is located at Convict Lake, primarily serving recreation and special use facilities.

White Mountain Ranger District: The current White Mountain Ranger Station was built in 1975 in Bishop. Administrative sites include: the White Mountain Compound (ranger station, visitor center, work center, fire station, and seasonal employee housing), the Rock Creek Fire Station (includes employee

housing), Mann Ranch (corrals and pack stock storage), and other barracks and utility buildings outside primary administrative sites. The Ancient Bristlecone Pine Forest Visitor Center at Schulman Grove was constructed in 2012 and is LEED gold certified. The majority of buildings are less than 45 years old. Twenty-eight percent are in poor condition, including a communications facility, half of the industrial facilities, one office, the day care, one service facility, and some storage facilities. The Rock Creek Fire Station site is served by a Forest Service- owned water system. The other administrative sites are served by municipal water systems. A Forest Service-owned and operated wastewater treatment plant is located at Rock Creek, serving the administrative site and recreation sites. The other administrative sites are served by municipal wastewater systems. A Forest Service-owned and operated wastewater treatment plant is also located at Bishop Creek, primarily serving recreation facilities and also serving the unincorporated community of Aspendell.

Mount Whitney Ranger District: This southernmost district currently has a ranger station located in Lone Pine and built in 1964. Administrative sites include: the Mount Whitney Compound (ranger station, work center, fire station, and employee housing), the Independence Heliport (includes an office and other support buildings), historical administrative sites at Casa Vieja and Monache, other cabins and utility buildings located outside primary administrative sites, and the Eastern Sierra Interagency Visitor Center. The visitor center was constructed in 2006 and is operated by a partnership of federal, state, and local government agencies. Most of the buildings are older than 20 years and are in good condition. Thirty-three percent are in poor condition, including a communications facility, one of two service facilities, and half of the storage facilities. The primary administrative sites are served by municipal water and wastewater systems. Forest Service-owned water systems exist at Casa Vieja and Monache, but are not actively managed.

Due to aging infrastructure, increasing deferred maintenance costs, increasing requirements for resource protection, and budget reductions, the agency is focused on decommissioning facilities and reducing square footage. Deferred maintenance of administrative buildings on the Inyo NF is valued at $2.2 million. The forest is currently completing a facilities master plan to help prioritize buildings to retain for existing use and buildings that could be decommissioned or converted to other uses. Structures over 45 years old must have historic evaluations completed before they can be modified or demolished. Without enough funding to perform these evaluations, modifications cannot be performed and buildings are often left to decay in place. The emphasis on sustainable operations of administrative facilities continues to grow, though there is minimal additional funding to implement new sustainable operations strategies. While Forest Service-owned water and wastewater systems indicate that they are meeting all operational safety requirements, some systems need to be physically repaired or reconfigured to meet current standards.

Recreation Facilities

Recreational facilities include buildings and other infrastructure maintained for public recreational use, such as campgrounds, day use areas, boating and swimming sites, and buildings located in these areas.

The Facilities Conditions Ratings (FCR) is used as the indicator for ease in summarizing data presented. FCRs do not exist for every building. Also, condition surveys of buildings are not performed on a regular basis due to lack of staffing. Therefore some FCRs may not accurately reflect current conditions. It could be generalized that FCRs presented in this document are higher than actual conditions. Building age is also not available for every building on the forest.

The Inyo NF offers facilities at developed recreation sites across the forest, including 70 campgrounds, 16 group campgrounds, two horse camps, 28 picnic or day use areas, five boating sites, and one swimming site (USFS 2007).

Mono Lake Ranger District: Twenty-one percent of recreation facilities are in good condition. The majority of recreation facilities are in poor condition, including one cabin, the entrance station, half of the interpretive kiosks, several flush toilets, and the majority of vault toilets. Four Forest Service-owned water systems serve recreation sites on the district. Other recreation sites are connected to municipal water systems. Recreation sites on the district are served by municipal wastewater systems.

Mammoth Ranger District: The majority of recreation facilities are in good condition. Twenty-eight percent are in poor condition, including over a quarter of flush toilets and one-third of vault toilets. Five Forest Service-owned water systems serve recreation sites on the district. Other recreation sites are connected to municipal water systems. Recreation facilities at Convict Lake are served by a Forest Service-owned and operated wastewater treatment plant. Recreation sites in the Reds Meadow Valley are served by a septic system. Other recreation sites are served by municipal wastewater systems.

White Mountain Ranger District: Just over half of the recreation facilities on this district are in good condition. Ten percent are in poor condition, including some flush toilets and a few vault toilets. Thirty-seven percent of facilities have not been assessed. Sixteen Forest Service-owned water systems serve recreation sites on the district. The wastewater treatment plants described previously serve recreation sites in the Bishop Creek and the Rock Creek areas.

Mount Whitney Ranger District: The only recreation facilities on this district are vault toilets. The majority of vault toilets are in good condition. None have been rated as being in poor condition. Over a quarter have not been assessed. Four Forest Service-owned water systems serve recreation sites on this district. This district generally provides vault toilets or holding tanks for facilities that are not connected to wastewater systems.

External to the Forest Service: The BLM, National Park Service, local governments and private entities provide recreation infrastructure in neighboring communities. This infrastructure tends to be concentrated along Highway 395, stretching the length of the Inyo NF between Olancha and Lee Vining. Developed recreation infrastructure can also be found in outlying communities near the forest including Dyer and Benton Hot Springs. Some of these areas provide infrastructure that is not typically provided at Inyo NF recreation sites. Examples include athletic fields, full hookup campsites for recreational vehicles, playgrounds, and swimming pools.

Trends related to recreational facilities are generally the same as for administrative facilities. According to the agency's infrastructure database, the deferred maintenance backlog for recreation buildings is $3.7 million and $3.2 million for recreation site amenities, such as campsites, food storage lockers, and picnic tables. The majority of the Inyo NF's campgrounds are run by concessionaires under four Granger-Thye permits. The current Granger-Thye authority allows a fee offset to occur, where the permittee returns a percentage of their proceeds back to the federal government for the purpose of maintaining the recreation sites under that permit. The amount of Granger-Thye funding received by the Inyo NF fluctuates each year. The forest received approximately $490,000 in fiscal year 2013. Although the Granger-Thye funding can be spent on campground road improvements, the funds have generally been used for major repairs of recreational facilities, helping to offset deferred maintenance. Due to the disparity between the funding needed to maintain recreation facilities and the funding received, partners will likely play an increasing

role in helping to meet recreation facility demands. Increasing demand for recreation opportunities on the forest is will likely add to the pressures on recreation facilities.

Public Utilities

Public utilities include public services such as water, power, waste treatment, and telecommunications to the general public provided by agencies and cooperatives. Infrastructure associated with these services include dams, municipal water systems, transmission and distribution power lines, fiber optic and phone lines, and communication facilities such as cell towers. These utilities either produce the services on NFS lands, such as hydroelectric power and water supply, or transport the service across NFS lands such as optical fiber and electrical distribution networks.

The major public utility companies that operate on the Inyo NF include Southern California Edison, Verizon of California, Verizon Wireless, AT&T, Los Angeles Department of Water and Power, California Broadband Cooperative, and Ormat Technologies, Inc. All occupy land throughout the Inyo NF, with the exception of Ormat, whose occupancy and use is limited to the Mammoth Ranger District. Power-related infrastructure on the forest includes transmission lines, sub-stations, distribution lines, and propane gas lines. Communication infrastructure on the forest is generally located at designated communications sites and includes telephone lines, fiber optic lines, cell towers, and radio and microwave dishes. Smaller water and sewage public utility companies are located on NFS lands adjacent to the communities of Lee Vining, June Lake, Mammoth Lakes, Crowley Lake, Sunny Slopes, and Aspendell. Public utilities may expand in the future as communities adjacent to the Inyo NF continue to develop, the demand for better connectivity increases, and new energy projects are developed on or off the forest.

Private Uses

Private infrastructure refers to privately-owned facilities used in conjunction with special use authorizations. They include buildings and other kinds of structures and improvements that represent a broad range of permitted recreation and land use activities.

There are 98 private water and wastewater permits on the Inyo NF, of which 37 are for private use and do not serve the general public. The forest has 22 recreation residence tracts, many of which have a community water system and access roads. These roads and water systems are under special use authorizations to the Recreation Residence Homeowners Association. Private uses that serve the public include resorts, ski areas, outfitting and guiding, stores, a gallery, and marinas. According to the agency's infrastructure database, there are about 12.5 private roads and 12.7 miles of commercial roads; however, these figures are likely an underestimate. As public demand for privately provided recreation opportunities increases, proposals for new infrastructure could increase.

Range Infrastructure

Grazing allotments on the Inyo NF include infrastructure to support the use of those allotments. This infrastructure mainly consists of range improvements, which include structures such as cabins, fences, handling facilities, and water developments. Range infrastructure helps meet management or resource goals and facilitates livestock management. Permittees are responsible for maintaining all range improvements listed in their grazing permits. Most ranchers who have permits for Inyo NF allotments also have permits or leases to graze on adjacent BLM or LADWP lands. Generally, Inyo NF allotments

provide a significant portion of summer forage for permittees that base their operations in or near Owens Valley. Several allotments on the southern end of the forest are considered "desert allotments" and offer winter or spring forage. There are multiple allotments that have unfenced boundaries with either BLM or LADWP grazing units.

The Inyo NF currently has 133 miles of fences, 12 buildings, and 13 handling facilities on active range allotments, the majority of which are found on the South Zone ranger districts. There are 27 miles of fences and 11 buildings on vacant range allotments. There are 106 water systems on active allotments, almost half of which are on the Mount Whitney Ranger District, and 34 water systems on vacant allotments, the majority of which are on the Mono Lake Ranger District. It is probable that most structures on vacant allotments are nonfunctional because of the lack of maintenance.

The condition and development of range infrastructure is expected to remain fairly stable under current management direction. Few new structures are installed each year. Structures on vacant allotments will continue to degrade. Normal wear and tear of structures on active allotments will continue to require maintenance by permittees and, in some cases, Forest Service personnel. Consistent allocation of a range improvement budget over the last few years indicates that sufficient funding likely will be available to process proposals for new structural projects.

Contributions the Plan Area Makes to Ecological, Social, or Economic Sustainability

Forest infrastructure contributes to ecological sustainability. Administrative facilities and the Inyo NF's transportation system support fuels management and forest health management activities. Though roads and trails have the potential to impact various resources managed on the forest, especially if poorly located or improperly maintained, they also help manage where and how forest uses occur. In addition, recreation facilities can prevent resource damage in heavily used areas.

Forest infrastructure contributes to socioeconomic sustainability by supporting the variety of activities that take place on the forest, including recreation, forest products gathering, mining, geothermal exploration, range uses, and traditional Native American uses. The ranching community depends on forest grazing allotments and associated infrastructure. Recreation and tourism is an important contributor to the local economy. Forest infrastructure plays an important role by providing access to the Inyo NF and supporting various types of recreation opportunities, including those authorized under special use permits. In addition, infrastructure maintenance and improvement projects can provide economic opportunities for local communities, particularly by breaking down larger projects, such as road maintenance work, so that they are accessible to local communities and can benefit multiple contract recipients (Charnley 2013).

Forest infrastructure also helps provide other services that support local communities. The transportation system is needed for fire suppression and search and rescue activities. Some Forest Service-owned and operated wastewater systems serve local communities. Many public utilities provide services to the general public by either producing the services on the Inyo NF, such as hydroelectric power and water supply, or by transporting the services across the forest, such as communication and electrical distribution networks.

Information Gaps

No formal condition surveys of Maintenance Level (ML) 3-5 roads have been performed. Information on the condition of these roads is currently based on specialist knowledge. Much of the information used to conduct this assessment generally comes from a Forest Service infrastructure database. However, not all data is current and some manual interpretation had to be performed. In general, the database provides an underestimate of what structures actually exist on the ground. Limited resources prevent forest staff from regularly performing condition surveys, which can underestimate the actual deferred maintenance cost reported in the infrastructure database. No data on the deferred maintenance of recreational water systems or wastewater systems exist. Information on public and private utilities was obtained through the Special Uses Data System (SUDS). The accuracy and completeness of information available from SUDS varies considerably.

Chapter 12: Areas of Tribal Importance

Important Information Evaluated in this Phase

In this chapter, Indian Tribes associated with the plan area, existing tribal rights, and areas of known tribal importance are identified. Existing information was used to assess condition and trend of resources that affect tribal rights and areas of tribal importance. This chapter summarizes information from the Inyo NF Chapter 12 topic paper. Additionally, information shared by tribes at formal meetings and with individuals in conversations provided a rich source of information on tribal perspectives, resource uses, topics of interest, and the unique relationships tribes share with federal government agencies.

Nature, Extent and Role of Existing Conditions and Future Trends

Indian Tribes Associated with the Plan Area

The Inyo NF is the traditional homeland of several Native American tribal communities and groups whose ancestors occupied the area at the time of first contact with Euro-American settlers around 150 years ago. Most of the resident tribes share a common ethnic heritage and speak different dialects within the Numic branch of the Uto-Aztecan language family. Although most scholars agree that human occupation of the area dates back as many as 10,000 years, the Numic-speaking Owens Valley Paiute first became identifiable archaeologically at around A.D. 600 to 1000 (Dean et al. 2004).

Tribes associated with the plan area include federally recognized tribes, California Native American tribes that are not federally recognized, and tribal organizations.

Federally recognized tribes:

1. Big Pine Paiute Tribe of Owens Valley
2. Bishop Paiute Tribe
3. Bridgeport Paiute Indian Colony
4. Death Valley Timbi-sha Shoshone Tribe

5. Fort Independence Indian Community of Paiute Indians
6. Lone Pine Paiute-Shoshone Tribe
7. Utu Utu Gwaitu Paiute Tribe of the Benton Paiute Reservation
8. Walker River Paiute Tribe of the Walker River Reservation

California Native American tribes – non-federally recognized:

1. Antelope Valley Indian Community
2. Kawiiasu Tribe
3. Kern Valley Tribal Council
4. Mono Lake Kutzadika'a Tribe
5. North Fork Mono Tribe
6. Tübatulabals of Kern Valley
7. Yosemite-Mono Lake Paiute Indian Community

Tribal organizations:

Mono Lake Kutzadika'a Indian Community Cultural Preservation Association

Existing Tribal Rights

Native Americans and Alaska Natives are recognized as people with distinct cultures and traditional values. They have a special and unique legal and political relationship with the United States government as defined by history, treaties, statutes, executive orders, court decisions, and the United States Constitution. The policy of the government is to support Native American cultural and political integrity, emphasizing self-determination and government-to-government relationships. Tribal consultation is required by federal law and is reinforced by court decisions, executive orders, and agency policies. More comprehensive information on federal laws and policies that affect tribal areas of interests on National Forest System (NFS) lands are found in the Sierra Nevada Bio-Regional Assessment.

The Inyo NF is responsible for ensuring that forest programs and activities honor Indian rights and privileges. Tribes throughout California have provisional rights to hunt, fish, and gather on traditional tribal lands now managed by federal agencies. Some rights are authorized through treaties. Additional agency policies that help to ensure the sustainability of tribal gathering on the Inyo NF include the Forest Service Pacific Southwest Region Traditional Gathering Policy and Inyo NF Pine Nut Gathering Policy. The forest continues to consult with federally-recognized tribes to determine how those rights may affect or be affected by management decisions.

Different types of agreements are used to strengthen and enhance relationships with tribes. The Inyo NF has a memorandum of understanding (MOU) in place for consultation with the Paiute Tribal Council to

provide a framework for government-to-government consultation and information sharing. The Inyo NF also has a data sharing agreement with the Big Pine Paiute Tribe of Owens Valley.

Areas of Known Tribal Importance

Identifying and evaluating areas of known tribal importance in the plan area or affected by management of the plan area is a challenging concept, given the tight bond between tribal people and the land. National Forest System lands are important to tribes and individual practitioners of traditional lifeways for a variety of reasons. A number of authorities and directives guide how the Forest Service consults with tribal governments to determine what topics and what areas are important to the indigenous people who use them.

Sacred sites important to Indian tribes are managed under Executive Order 13007 (1996), which defines an Indian sacred site as:

> Any specific, discrete, narrowly delineated location on federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site.

In order to improve the Forest Service's overall relationships with tribes and, in particular, how the agency manages sacred sites, the U.S. Department of Agriculture's Office of Tribal Relations and the Forest Service, in dialogue with American Indian and Alaska Native tribal leaders, developed a 2012 report that outlined recommended policy changes to the Secretary of the Department of Agriculture. One of the challenges with managing sacred sites is that they are often carefully guarded secrets that are only provided to select members of a tribal community and rarely, if ever, to outsiders.

Traditional cultural properties (TCPs) are managed under the authority of the National Historic Preservation Act (NHPA), are eligible for listing on the National Register of Historic Places, and must be a tangible property. TCPs were first defined in 1990 in National Register Bulletin 38 (Parker and King 1990) as properties "eligible for inclusion in the National Register because of [their] association with cultural practices or beliefs of a community that (a) are rooted in that community's history and (b) are important in maintaining the cultural identity of the community." As with sacred sites, the location of TCPs is very sensitive information. The Inyo NF currently has one TCP identified.

Traditional gathering areas consist of specific geographical locations where select resources are gathered for traditional subsistence uses and medicinal practices. Materials can include fuel, food items, medicinal plants, building materials, and raw material for arts and crafts. Some examples of important items gathered on the Inyo NF include pine nuts, firewood, plant materials for basketry and other traditional crafts, and Pandora moth larva in Jeffrey pine stands. Specific locations of traditional gatherings are often guarded secrets. Though these locations are often not disclosed to the agency, protecting such areas falls under the forest's trust responsibilities to Native Americans.

Mono Tribes travel annually from the west side of the Sierra Nevada to commemorate traditional walks by traversing east-side trails to high meadows on the west side of the Sierra Crest. These trans-Sierran walks memorialize the traditional trade routes and cultural exchanges between the Paiute/Shoshone Indians of the Owens Valley and the Mono and Miwok Indians on the west side of the Sierra Crest.

There are five reservations in close proximity to the Inyo NF located in the communities of Lone Pine, Independence, Benton, Big Pine, and Bishop. These tribally-administered lands influence the economy and environment of the surrounding communities and lands.

Paiute communities practiced irrigation of traditional food plants at the time of contact with European settlers. Watershed management policies on National Forest System (NFS) lands have the potential to affect water sources, trees, shrubs, grasses, food, and traditional subsistence practices among the indigenous population. Springs, streams, and lakes are frequently associated with important Paiute and Shoshone legends and sacred areas. See Chapter 2 of this assessment for information about water quality and quantity, and Chapter 8 of this assessment for information about water rights and uses.

Tribes have expressed interest in developing co-management areas with the Inyo NF to integrate traditional ecological knowledge into more conventional management regimes. Tribes are also interested in small parcel transfers to acquire forest lands adjacent to reservations to meet community or cultural objectives.

Forest activities contribute to the socioeconomic health of local communities, including tribal communities. Tribes are interested in working with the Inyo NF to enhance economic opportunities and identify career paths with the forest for tribal members. Tribes are concerned about retaining access to areas important for cultural, economic, and recreational activities, including pine nut gathering areas, sacred and ceremonial areas, and traditional activity areas. Transmitting traditional knowledge to their youth and fostering their connection to the land is important for tribes. The Inyo NF collaborates with tribes and tribal groups to bring their youth out to the forest to learn about the land and to expose them to careers with land management agencies.

Conditions and Trend of Resources that Affect Tribal Rights and Areas of Tribal Importance

The Inyo NF continues to support management of vegetation important to tribes. The forest continues to develop and designate fuelwood collecting areas and has developed a policy to allow designated surrogates to gather fuelwood on behalf of tribal elders and disabled members who cannot gather wood for themselves.

Partnerships and co-management opportunities between the Forest Service and tribes are expanding and gaining more interest. There are new opportunities for tribal member careers with the Forest Service. However, declining federal budgets may reduce the availability of resources for contracting and hiring.

The Forest Service continues to support and facilitate access to traditional trails and ceremonial areas. The Inyo NF designated a system of motorized vehicle routes in 2009. The subsequent maintenance, construction, and/or decommissioning of roads and trails are viewed differently by different tribal individuals. Upgrading a road may facilitate access to areas of tribal importance. Conversely, improvements can also diminish those qualities held to be sacred or culturally significant and can potentially introduce traffic into areas used for ceremonies. Decommissioning roads can negatively affect Native American individuals by inhibiting access to traditionally important areas. The ground disturbance associated with decommissioning has the potential to disturb archaeological deposits on or near the road. At the same time, reducing access can also prevent vandalism and damage to cultural resource sites.

Scenery management on the Inyo NF is important to Tribal governments and individuals. The Native American community feels a close association with cultural and historic landscapes. Proper scenery management can have a beneficial effect by preserving appearance of the natural landscape. Any alteration or degradation of scenic integrity may negatively affect cultural or historic landscapes or traditional cultural properties.

Impacts of recreation to local tribal cultures need to be taken into account as well. The agency is required by law to administer the National Forest System for outdoor recreation, among other uses including range, timber, water, wildlife and fish. Untold numbers of Native American sacred sites and traditional places are located on these same lands, and tribal practices are tied to these resources. Economic and recreational drivers are important in land management decision-making, but sacred site concerns are equally important. American Indians have historic, contemporary, and symbolic links with the landscapes-of the western United States, including the landscapes in and near the major recreation, park and tourism resources. Increasing user visits or directing recreational or user traffic toward sacred sites or traditional cultural properties may have an adverse effect on the location, as well as the religious, ceremonial or cultural activity of the tribes.

Decreasing federal budgets and resources are expected to generate challenges for the tribal program in the near future. Personal, face-to face interaction with tribal members is vital to developing successful relationships with tribal communities and limited resources will inhibit such opportunities.

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

The plan area contributes to social and economic sustainability by helping to maintain Native American culture, traditions, and lifeways, which are deeply connected to the land. Every national forest is carved out of ancestral Native American land, and Native American historical and spiritual connection to the land has not been extinguished or diminished despite these changes in title. For thousands of years, their land use ethic included spiritual, philosophical, and economic dimensions (Anderson and Moratto 1996). Many Native Americans participate in traditional activities, such as hunting, fishing, trapping, and gathering, and do not differentiate these activities into distinct categories, such as work, leisure, family, culture, and tradition (McAvoy et al. 2004). These activities carry on family and tribal traditions, provide sustenance for families, and continue a spiritual connection to the land and to animal and plant resources (McAvoy et al. 2004). These activities, and the places connected to them, have cultural, symbolic, and spiritual as well as functional meanings (McAvoy et al. 2004).

Tribal communities within the Sierra Nevada present distinctive opportunities for mutually beneficial partnerships to restore ecologically and culturally significant resources, and to promote resilience (Charnley et al. 2013). Traditional ecological knowledge and respect for the land and its resources have been handed down from generation to generation. Traditional ecological knowledge and western science can be blended for successful outcomes on the landscape. In addition, working with tribes can provide them with more opportunities to be direct stewards of the land, which is a vital part of Native American culture, where humans are viewed as part of the natural system, helping to ensure abundance and diversity of plant and animal life (Anderson and Moratto 1996). Active participation in forest management activities can also create jobs and improve economies in tribal communities.

Information Gaps

The Inyo NF will continue to consult with tribes regarding the effects of our undertakings to identify traditionally or spiritually sensitive areas. Limited information is available on condition and trend of resources that affect tribal rights and areas of tribal importance. Part of this is due to the nature of areas of tribal importance. Many of these areas are sensitive or sacred, and tribes wish to keep these areas confidential in order to protect them.

Chapter 13: Cultural and Historical Resources and Uses

Important Information Evaluated in this Phase

In this chapter, cultural and historical context of the Inyo NF is examined and cultural and historic resources present in the plan area are identified. Existing information is used to assess the condition of these resources, including historic properties in the plan area identified as eligible or listed in the National Register of Historic Places and designated traditional cultural properties. Trends that affect these conditions or demand for these resources are also assessed. This chapter summarizes information from the Inyo NF Chapter 13 topic paper.

Nature, Extent and Role of Existing Conditions and Future Trends

Cultural and Historical Context

Prehistoric Period

The lands of the Inyo NF represent a cultural ecotone, meaning they connect the cultures of the Great Basin with those of central California. For an area possessing an extremely rich record of the human past, the forest has received proportionately little systematic archaeological and historical research.

Lands that now compose the Inyo NF have been used for human subsistence purposes for at least 12,000 years. The following large scale adaptive strategies are generally accepted for the cultures of the Western Great Basin (following Elston 1986) although specific time spans of the chronological subdivisions can vary based on individual interpretive preferences.

Early Archaic Period (5000-2000 B.C.): This period was once thought to have been characterized by continent-wide drought conditions, though more recent research suggests that while conditions were warmer than earlier times, they did not rise to the level of drought. Archaeological evidence suggests that humans in the eastern Sierra Nevada were highly mobile and used plant foods and milling equipment during this period.

Middle Archaic Period (2000 B.C.-500 A.D.): This period was marked by cooler, wetter conditions. The high degree of residential mobility in the eastern Sierra Nevada continued into this period with a gradual expansion of subsistence activities. In Owens Valley, site locations shifted from riparian areas to modern desert scrub (Bettinger 1989). A trade system starts to develop and milling equipment becomes more formalized and diversified. By the end of this period, sites became quite specialized.

Late Archaic Period (500 A.D.-Euro-American contact): During this time period, wetter periods were punctuated by drier periods, notably the Mediaeval Warm Period and Little Ice Age. This period saw a marked cultural change in the western Great Basin, including a shift to the use of bow and arrow, as well as the appearance of high elevation village sites in the White Mountains. The Numic branch of the Uto-Aztecan language family expanded across the western Great Basin, likely originating in the southwestern Great Basin and spreading relatively late during the Prehistoric Period.

In the eastern Sierra, settlement patterns that began during the Middle Archaic Period continued in Owens Valley and Mono Basin, along with increased use of the Sierra Nevada uplands and the Inyo-White Mountains range. Acorns acquired though trade were incorporated into the diet of people in Long Valley and the Mono Basin. Intensive use of pinyon began in central Owens Valley (Bettinger 1989). The introduction of irrigation around 1,000 years ago may have resulted in decreased big game hunting and a decreased use of upland and desert scrub hunting camps.

There was an increased use of marginal environments, indicating an intensified use of resources. The use of kutsavi (brine fly pupae) may date to this period. Use of piagi (Pandora moth larvae) occurred later, following a volcanic eruption 600 years ago that leveled the existing forest and established new habitat for the moth. Both Long Valley and Mono Basin have evidence of pronounced interaction between the people of the western slopes of the Sierra Nevada and the people of the eastern Sierra and Great Basin.

Historic Period

Native Americans

The earliest contact with Euro-Americans in the eastern Sierra Nevada and western Great Basin likely occurred in the 1820s as trappers began canvasing the western Great Basin and California for beaver. Euro-American involvement with the eastern Sierra Nevada, including the eastern slope of the Sierra Nevada and western edge of the Great Basin, was largely transitory prior to the discovery of gold on Dog Creek in 1857 (DeDecker 1933). The growing mining industry created a tremendous demand for supplies and growth of settlements, which encroached on lands and resources critical to the Paiute economy (McGrath 1984). This quickly led to conflict, violence, and failed efforts to relocate the Paiute (McGrath 1984). The latter half of the 19th century was a time of major economic transition as the native people of the eastern and southern Sierra began incorporating Euro-American materials into their traditional lifeways and patterns of subsistence.

Mining

The history of mining on the Inyo NF has never been fully synthesized though several mining districts on the forest were the subject of studies between 2010 and 2012. As result of these studies a very general outline of the founding and proliferation of the eastern Sierra Nevada mining industry has emerged and many data gaps have yet to be addressed. While gold was first discovered in Mono Basin in 1827, proliferation of the mining industry began in earnest with the discovery of the Esmeralda Mining District in 1860, penetrating the Sierra crest in a number of places by the end of the decade. Industrial methods and technology then began to be applied in many mining districts, and the mining industry followed a boom and bust cycle that occurred inversely compared to the national economy. War also drove the mining industry.

Logging

Unlike the forests on the western slopes of the Sierra Nevada, the logging industry of the Inyo NF tended to play a supporting role to the mining industry. By the 1860s, the booming mining industry that centered around Bodie and Aurora created a tremendous demand for forest products—timbers for the mines, lumber for the town, and fuel wood for the town and the mills (Wedertz 1978). Fluctuations in the mining industry were reflected in the ebb and flow of the logging industry. Apart from Mono Mills, the logging industry of the forest has yet to receive systematic historical or archaeological study.

Railroads

Two narrow-gauge railroads were operated on lands now administered by the Inyo NF: The Carson and Colorado and the Bodie Railway and Lumber Company (Myrick 1962). In response to the booming mining industry, the Carson and Colorado was built in the 1880s from the Carson River near Carson City to the Colorado River near Fort Mohave. The slowing of the mining industry during the 1920s and 30s, coupled with the proliferation of highways, led to the abandonment of stretches of railroad. By 1960, traffic on the remaining stretch between Laws and Keeler had diminished to the point of abandonment.

In 1881, the Bodie Railway was built to connect Bodie with the Jeffrey pine forests located to the south of Mono Lake. Despite the labor issues associated with the use of Chinese workers, by October trains were running and a large sawmill had been constructed at Mono Mills. By the mid-1880s, when the mines of Bodie began to bust, the activity of the railroad declined and was dormant from 1890 until 1893, when it resumed operation to supply fuelwood and lumber. In 1917, the railway was abandoned after diminished returns and the closure of the Standard Mine in 1914.

Ranching

In the early 1860s, ranchers began driving stock into the region from the Central Valley (McGrath 1984). With the cessation of the Owens Valley War and the continually developing mining industry, ranching became firmly established. Public land grazing in the region became a priority for the agency with the formation of the Inyo Forest Reserve in 1893. Despite the role that the ranching industry played in early settlement of the region, it has received very little archaeological or historical study on the Inyo NF.

Hydropower

The history of hydroelectric systems of the Inyo NF have not as a whole received a systematic study, though the historical contexts of some individual plants have been prepared. The best sketch of the industry in the eastern Sierra is found in Diamond and Hicks (1988) and Myers (1986). The Inyo NF was home to some of the earliest hydroelectric systems in California. As early as 1891, mining companies were installing hydroelectric systems to provide power for their mining operations. Hydroelectric projects were built throughout the early 1900s, many of which were built by the Nevada-California and Pacific Power Companies, which eventually merged in 1917 and then became part of Southern California Edison in 1964.

Recreation

Stock packing across the Sierra Nevada arguably began in the 1820s with the passage of fur traders (Jackson 2004). By the mid-1850s, a number of pack routes were being surveyed across the central Sierra Nevada, many of which followed aboriginal trails. Mining discoveries in the Inyo Mountains also resulted in the proliferation of pack trails. The late 1860s saw the emergence of recreational packing in the Sierra Nevada. The 1920s saw a growing interest in backcountry recreation, and demand for pack outfits grew. World War II significantly curtailed recreation, including the pack industry. Many found it difficult to earn a living after the war, and a number of long term operators sold their outfits in the 1950s and 1960s.

The emerging interest in recreational use of public lands in the 1890s was accompanied by a demand for summer or vacation homes sited on public lands. During the 1930s, the agency began to increasingly emphasize campgrounds over recreational residences as they tried to address and plan for the projected growth in recreation. In the 1950s, the agency stopped issuing new permits for the recreation residence program. On the Inyo NF, 27 recreation residence tracts were established before 1968, when a moratorium was issued on the recreation residence program nationwide.

Paralleling the growth of recreation residences and the packing industry in the Sierra Nevada was the establishment of high-country resorts on public lands, one of the earliest of which was Tiago Pass Resort. Additionally, the proliferation of automobiles fueled the growth of the resort industry.

Forest Service

On February 14, 1893, the Sierra Forest Reserve was established and placed under the administration of the Department of the Interior. Between 1899 and 1901 the "East Side" of the Sierra Forest Reserve was administered as a separate unit. In 1905 President Roosevelt transferred administrative responsibilities for forest reserves to the Department of Agriculture, under the newly created Forest Service. On May 25, 1907, President Theodore Roosevelt created the Inyo NF by Proclamation when he withdrew 221,324 acres of land from the Sierra Forest Reserve. After various management configurations, the Inyo NF assumed its present configuration with the merging of the Mono NF with the Inyo NF in 1942.

Cultural and Historic Resources Present in the Plan Area

Cultural resources are defined by the National Historic Preservation Act (NHPA) and by Forest Service Manual (FSM 2300, Section 2360) direction as:

> an object or definite location of human activity, occupation, or use identifiable through field survey, historical documentation, or oral evidence. Cultural resources are prehistoric, historic, archaeological, or architectural sites, structures, places, or objects and traditional cultural properties.

Native American resources are classified as prehistoric, while historic sites are typically those associated with the historic period described above. Historic sites are typically associated with mining, logging, ranching, hydroelectric infrastructure, and the Forest Service. The Inyo NF manages 5,501 known cultural resource sites. There are 2,454 prehistoric resource sites, approximately 45 percent of the total, and 793 historic resource sites, or 14 percent of the total. A number of historic districts associated with the mining industry have been tentatively identified, but have not been formally recorded or nominated for listing under the National Register of Historic Places. There are 155 multi-component resource sites, referring to

those with both Native American archaeological and historic period cultural material and features. Of the total known cultural resource sites in the plan area, 2,099 have not been identified and classified.

The Inyo NF has not been fully surveyed for cultural resources. Many are located in remote locations, where the forest has not been very active historically. Additionally, many of the early archaeological surveys of the forest used standards and methods that are no longer considered professionally adequate. Given these caveats, and based on the large percentage of the forest that has received little or no archaeological survey, it is estimated that 10,000 to 15,000 cultural resource sites may exist on the Inyo NF.

Condition of Known Cultural and Historic Resources

The National Historic Preservation Act of 1966, as amended (NHPA), identified the responsibilities of federal agencies for historic preservation, and established the process and requirements for evaluating significance of cultural resources. Additionally, it directed the Secretary of the Department of the Interior to create a National Register of Historic Places (NRHP). Within the guidelines of the NRHP, cultural resources are: eligible for listing on the NRHP, not eligible for listing, or have not been evaluated. Those resources that have not been evaluated are treated as if they are eligible for listing until such time as a formal evaluation is completed.

Of the 5,501 known cultural resource sites, 244 sites (four percent) have been evaluated as eligible for listing on the NRHP. Another 814 sites (15 percent) have been evaluated as ineligible. The remaining 4,443 sites (81 percent) have not been formally evaluated for NRHP eligibility. The forest does not currently have any historic properties listed on the NRHP. However, nominations for two properties exist in draft form. Traditional Cultural Properties (TCPs) are included in the NRHP as well. The Inyo NF has one TCP. See Chapter 12 of this assessment for more information. The forest has identified 192 historic buildings (45 years of age or older). One has been evaluated as not eligible for listing on the NRHP. The remaining buildings have not been evaluated.

An important part of managing cultural resources is identifying their condition. The existing condition of the resource affects its significance under the NHPA, its listing on the NRHP, and identifies what actions need to occur in order to maintain, protect, and interpret it. The NHPA requires that the forest monitor and record the condition of cultural resources in order to ensure their sustainability, and to identify and report adverse effects.

Of the resources recorded on the forest, 2,069 resources have been noted as being disturbed, while 422 have no disturbance documented. Condition assessment data are not available for the remaining 3,010 sites. Common disturbance agents observed on the forest include recreation, livestock grazing, looting/vandalism, forest-permitted projects, and natural erosion. Condition assessments are subject to a certain degree of subjectivity. Because the majority of sites have not been evaluated for listing eligibility on the NRHP, it is unknown whether sites noted as disturbed are sites eligible for listing. Impacts to resources ultimately determined not eligible for listing may be of lesser concern.

Trends Affecting Condition of Cultural and Historic Resources or Demand for these Resources

Legal compliance with Section 106 of the National Historic Preservation Act (NHPA) has been the focus of cultural resource management activities on the forest. The majority of the work has focused on

avoiding direct and indirect physical effects to cultural resources during project implementation, and ensuring confidentiality of their locations. There is little to no qualitative or quantitative information about trends that affect their condition or the demand for their use. However, some general, overarching trends expected to drive change over the next ten to twenty years and beyond are discussed below.

Climate Change

The impact that climate change may have on cultural resources is a topic that has received little attention or formal study. One may postulate that cultural resources may be affected as a result of altered erosional or hydrologic regimes (due to changes in the timing and intensity of storms), changes in vegetation that may lead to altered rates of soil development or degradation, and potential shifts in decay rates of organic cultural materials if precipitation patterns are altered.

Recreation Use

Many of the natural characteristics that attracted past human use of the land such as shade, water, foodstuff, shelter, fuel, and viewsheds are the same that attract modern recreationalists. Consequently, recreational activities often occur in or adjacent to cultural resources. Some effects are benign, while others significantly damage or destroy attributes that contribute to a cultural resource's historical significance. Additionally, human refuse and waste can introduce modern materials into the archaeological record of a cultural resource, impacting its ability to convey information of past human activities. As demand for recreation increases and agency budgets decrease, the forest will be challenged to protect and preserve these non-renewable resources.

Illegal Activities

Archaeological and historical sites are common targets of looting and vandalism. Removing archaeological deposits destroys the potential for scientific analyses and interpretation. Vandalism occurs both casually and deliberately. While damaging, casual vandalism associated with recreation is often a product of convenience and spontaneity. The goal of the activity is rarely destructive. Deliberative vandalism or looting of a resource targets the resource with malicious intent. It is difficult to accurately quantify trends in the frequency of looting and vandalism of archaeological and historical sites because limited resources constrain the number of sites that can be monitored each year. Anticipated decreases in annual budgets and staffing shortfalls are expected to further restrict the forest's ability to conduct regular condition assessments. Looting and vandalism is expected to continue at steady or increased rates, but the forest's ability to properly identify these cases and assess the effects on cultural resources is expected to be further hampered.

Marijuana cultivation on NFS lands is increasing. It is associated with many of the features sought by past humans, including shade, shelter, and water. As a result, grow sites often are located in or adjacent to cultural resources. The cultivation of marijuana is ground-disturbing and can damage or destroy archaeological deposits and features of a cultural resource. Additionally, eradication efforts are themselves ground-disturbing and can potentially impact cultural resources. Because activities are often conducted in secret by both growers and law enforcement who combat them, impacts to cultural resources may be left undocumented. Marijuana cultivation on NFS lands also impacts cultural resources.

Heritage Tourism

The public's interest in heritage tourism is on the rise, which can have both positive and negative effects on cultural resources. It exposes visitors to the value of cultural resources, which can aid in their preservation. Heritage tourism can also contribute to local economies, especially economically depressed rural communities. At the same time, many cultural resources consist of sensitive archaeological deposits and features that may be unintentionally damaged by curious visitors. Additionally, heritage tourism can attract more attention to sites and increase the risk of looting or vandalism. Regulating heritage tourism is challenging, as the agency cannot exclude it from particular areas without running the risk of disclosing the locations of cultural resources, which is prohibited by Section 304 of the NHPA.

Native American Traditional Use

There is increasing interest in Native American traditional use of cultural resources. This poses an interesting conundrum for cultural resource management. Cultural resources are often perceived as a snapshot in time of materials or places that are no longer used. However, the archaeological record is dynamic. Consequently, it can be difficult to assess the impact of continued traditional use of a resource.

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

Cultural uses or cultural and historic resources contribute to sustainability through archaeological deposits that serve as archives of scientific data. These deposits serve as the most important source of scientific data documenting past human adaptations to climate change. This information, along with historical records and traditional ecological knowledge provide a baseline of information valuable for ecological restoration and sustainability projects. Cultural and historic resources on the Inyo NF not only make scientific contributions to our society, but expand our knowledge and understanding of history and culture, and help us connect to our heritage. Cultural resources can also offer highly personal, inspiring, and spiritual experiences. The Inyo NF's heritage resources program can help enhance local communities socioeconomically by providing opportunities for employment and income from heritage tourism and recreation. Additionally, cultural resources provide socioeconomic benefits to tribal communities through heritage tourism and opportunities for cultural traditions and ceremonies that strengthen their sense of place and self. Cultural resources are a primary component of the Inyo NF's mandated trust responsibility to Indian Tribes.

Information Gaps

Over the years, significant archaeological and historical research has taken place on the Inyo NF, yet data gaps remain for several historic-period resources. Additional sites, districts, traditional cultural properties, and cultural landscapes likely exist but have yet to be identified and evaluated. For those resources that have been identified, limited information is available regarding their condition because the majority has not yet been evaluated. Additionally, many of the early archaeological surveys of the forest used standards and methods that are no longer considered professionally adequate.

Chapter 14: Lands

Important Information Evaluated in this Phase

This chapter identifies patterns of and trends affecting land ownership, status, and use within and near the plan area. It examines the influence of the plan area on land ownership, status, and use within the broader landscape. It also looks at access to the plan area, and land status and ownership trends influencing access and use. This chapter summarizes information from the Inyo NF Chapter 14 topic paper.

Nature, Extent and Role of Existing Conditions and Future Trends

Land Ownership

Land ownership is the basic pattern of public and private ownership of surface and subsurface estates. Land owned by the Inyo NF is fairly consolidated and includes both surface and subsurface estates. The Inyo NF has had a fairly active land exchange program over the years, allowing it to acquire many of its high priority parcels. There are few non-federal parcels left within the forest boundary that are desirable and available for acquisition.

The Inyo NF's administrative boundary encompasses a total of 1,953,326 acres. Of these, 20,381 acres are owned by the Los Angeles Department of Water and Power (LADWP) and 32,340 acres are in other private ownership. In 1988, it was estimated that there were 50 unresolved encroachments on the Inyo NF, which have likely increased since then. The forest is primarily bordered by lands managed by other units of the Forest Service, the National Park Service (NPS), the Bureau of Land Management (BLM), and LADWP. The Inyo NF administers portions of the Humboldt-Toiyabe NFs in the Pizona area and portions of the Sierra NF in the Cascade Valley area of within the John Muir Wilderness.

The Inyo NF comprises large portions of Mono (41 percent) and Inyo (12 percent) Counties, as well as small portions of Tulare (six percent), Madera (four percent), Fresno (less than one percent), and Tuolumne (less than one percent) Counties. The forest also comprises small portions of Esmeralda (three percent) and Mineral (two percent) Counties in Nevada. Almost 97 percent of Inyo County and 94 percent of Mono County are owned by public agencies. These land ownership patterns in Inyo and Mono Counties have led to a unique situation for local communities in the eastern Sierra Nevada. Because they are largely surrounded by public land holdings, communities are protected from over development while at the same time constrained from logical and sustainable growth (Eastern Sierra Land Ownership Adjustment Project 2012). Mono and Inyo Counties continue to have concerns about future opportunities for local communities. Because so little of the land is in private ownership, land ownership has a big influence on social, economic, and ecological conditions. The tax base is very limited due to the lack of lands suitable for development. At the same time, the unique land ownership pattern also acts as a draw for millions of visitors to the eastern Sierra Nevada each year, contributing to the travel and tourism industries and generating local jobs. For more information see Chapter 6 of this assessment.

Land Status and Uses

Land status is the zoning for private lands and formal management status of public lands. Land use is the current use of land, such as residential, commercial, industrial, or agricultural use.

One trend that may affect land status on the Inyo NF is population growth in southern California. The Inyo NF is a very popular recreation destination for people who live in southern California. As the population increases, recreation pressure is expected to increase, which could influence the zoning of NFS lands to address the additional pressures and protect resources. Another trend is the increasing demand for communications technology. NFS lands often provide the highest points on the landscape, which are desirable for providing good internet and cell phone coverage. Communication sites are critical for the wireless industry, which is increasingly trying to provide access to remote and isolated communities who want to be more connected.

Due to the large amount of public land in both Inyo and Mono Counties, land status changes by public land managers could influence social and economic conditions in these counties. Acquisition of private land by public land management agencies could further reduce the tax base. Changes to lands status on the Inyo NF influence the types of activities that can occur on the forest. Areas that are withdrawn from mineral entry could reduce or eliminate opportunities for commercial mining activities and associated income. In general, any changes in land status that reduce commercial enterprises on public lands could negatively impact local economies. At the same time, these same designations can provide additional recreation opportunities.

Land status changes on lands managed by the LADWP could also influence the social, economic and ecological conditions in Inyo County. Particularly, any changes to water withdrawals could impact ecological conditions in the Owens Valley, which in turn could affect recreational use and impact social and economic conditions.

Inyo NF

The Inyo NF was established on May 25, 1907 by Presidential Proclamation. On July 1, 1945 land from the former Mono National Forest was added. These lands were “reserved” from the public domain (land owned by the federal government), for the establishment of national forests. Many land ownership adjustments have occurred since the creation of the Inyo NF through exchanges, purchases and donations. A withdrawal is an action which restricts the disposal and use of public lands and which holds them for specific public purposes and programs. Typical withdrawals serve to restrict mineral entry under the U.S. Mining Law Act of 1872, and disposal of the land via exchange. Examples of withdrawals on the Inyo NF include power withdrawals around hydroelectric facilities, geothermal withdrawals on lands within the Mono-Long Valley known geothermal resource areas, and mineral withdrawals within developed recreational sites such as campgrounds. Other lands withdrawn from mineral entry include the Mono Basin National Forest Scenic Area and all designated wilderness areas. For more information see Chapter 15 of this assessment. Approximately 46 percent of the forest is currently designated wilderness. Withdrawals on the Inyo NF have not been reviewed for many years, and some may have expired. When conveying out of federal lands, the U.S. may reserve certain rights, such as rights to use certain roads, water rights, and mineral rights. Lands acquired by the federal government may also be encumbered by similar reservations made by the grantor, and/or by third party rights, which commonly include power lines, communication lines, other utilities, and roads.

The Inyo NF’s 1988 LRMP identified geographic management areas across the forest and associated management prescriptions. The 19 management prescriptions from the 1988 LRMP are described in the table below. Since 1998, several amendments to the LRMP that are still in effect today have changed acres and locations of various management area prescriptions, including: the South Sierra Wilderness

Management Plan (1991), motor vehicle direction (1993), Wild and Scenic River Management Plan: North and South Forks of the Kern (1994),forest-wide range utilization standards (1995), management direction for the Ansel Adams, John Muir, and Dinky Lakes Wildernesses (2001), and Sierra Nevada Forest Plan Amendment (2004) and Management Indicator Species Amendment (2007).

Management prescriptions from the 1988 LRMP

Management Prescription	Purpose	Acres
1 – Designated Wilderness	To protect wild lands and their wilderness values of natural ecological integrity and natural appearance.	949,115
2 – Proposed Wilderness	To recognize and protect wilderness attributes of Further Planning Areas recommended for wilderness pending Congressional designation.	1,764
3 – Mountain Sheep Habitat	To provide high quality habitat for Mountain sheep to maintain or enhance existing population levels.	73,801
4 – Mule Deer Habitat	To preserve or enhance key mule deer habitat in order to maintain or increase existing population levels.	110,129
5 – Research Natural Areas	To maintain the ecological integrity of target vegetation types, for research, study, and observation.	15,318
6 – Mono Basin National Forest Scenic Area	To provide for the management of the Mono Basin National Forest Scenic Area as directed by the California Wilderness Act of 1984 (P.L. 98 425).	108,673
7 – Ancient Bristlecone Pine Forest	To protect the Ancient Bristlecone Pines for public enjoyment and scientific study. The area is classified as a Special Interest Area.	28,805
8 – Wild and Scenic Rivers	To maintain rivers that have been recommended or designated in a free flowing condition.	28,418
9 – Uneven-aged Timber Management	To manage suitable timberlands for the production of wood products using silvicultural treatments that maintain options for other resource emphases during the planning period.	8,765
10 – High Level Timber Management	To manage suitable timberlands for maximum production of wood. Management of other resources will be compatible with timber management activities.	73,751
11 - Range	To maintain or increase forage production and achieve uniform livestock distribution through maintenance or expansion of structural and nonstructural range improvements.	136,184
12 – Concentrated Recreation Area	To manage concentrated recreation areas to maintain or enhance major recreational values and opportunities.	50,459
13 – Alpine Ski Area, Existing and Under Study	To maintain and manage existing downhill ski areas for public use and to complete ski area studies currently in progress.	8,919
14 – Potential Alpine Ski Area	To maintain the potential for alpine ski development on those areas of the forest offering downhill skiing opportunities of the highest quality. Manage areas with this prescription to retain their value as potential downhill ski developments.	4,006
15 – Developed Recreation Site	To maintain developed recreational facilities, to provide necessary user services and to protect forest resource values.	1,329
16 – Dispersed Recreation	To maintain the potential for both winter and summer high quality dispersed recreation opportunities.	5,758
17 – Semi-Primitive Recreation	To limit vehicular access to existing designated routes to protect and maintain recreation and/or wildlife values.	351,692
18 – Multiple Resource Area	To allow vehicle access on existing routes and areas designated as open. Roads can be constructed or upgraded to facilitate vehicle access for a full range of resource activities.	186,291

Other Federal Land Management Agencies

Toiyabe National Forest: The 1986 Toiyabe NF's LRMP has two management areas adjacent to the Inyo NF: Walker and Bridgeport Pinyon/Juniper. Walker management area emphasizes wildlife, dispersed recreation, developed recreation, and water quality. This management area provides for orderly mineral resource activities. Of the total 215,935 acres, 72,200 were designated as wilderness in 2009.

Death Valley National Park: Death Valley NP has a 2002 General Management Plan (GMP). About 95 percent of the park is designated as wilderness. The NPS manages wilderness for the use and enjoyment of the American people in a way that would leave them unimpaired for future use and enjoyment as wilderness.

Devil's Postpile National Monument: Devil's Postpile National Monument (Monument) is managed by the NPS, which is currently working on a GMP. The Monument and Inyo NF closely share natural resources and visitors. The Monument is working with the Inyo NF on its GMP, which will include recommendations for the surrounding lands managed by the forest that could be adopted by and incorporated into future forest planning.

Bureau of Land Management: The BLM has three field offices adjacent to the Inyo NF. The Carson City Field Office has a 2001 Consolidated Resource Management Plan. The Bishop Field Office has a 1993 Resource Management Plan, which is scheduled for an update in 2014. The Ridgecrest Field Office is part of the larger California Desert District of the BLM, which completed a California Desert Conservation Area Plan in 1980. It has been amended several times since 1980. The 1988 Nevada Enhancement Act transferred about 50,000 acres from the BLM to the Inyo NF. Because the transfer occurred after completion of the forest's LRMP, management of this area comes from the plans in place at the time of the transfer. BLM resource management plans make decisions about transferring or disposing public lands for community expansion and development, utility distribution, and recreation.

Interagency Energy Planning: The Desert Renewable Energy Conservation Plan (DRECP) Area includes the desert regions and adjacent lands in Imperial, Kern, Los Angeles, Riverside, San Bernardino, and San Diego Counties. The DRECP Area covers about 22.6 million acres. The purpose is to conserve and manage plant and wildlife communities in the Mojave and Sonoran Desert regions of California while facilitating the timely permitting of compatible renewable energy projects. The Forest Service is not a participation agency, and NFS lands are excluded from the DRECP Area. However, the DRECP will affect renewable energy development within the plan area.

Counties

Esmeralda County, Nevada: The 2011 Esmeralda County General Plan classifies their land into three categories: multiple use, agriculture, and community and commercial industrial use. Multiple use is used for public lands. Under this category grazing, mining, prospecting, recreation, and other activities are recommended under a multiple use/sustained yield concept and in a manner that will conserve natural resources and provide for the long term benefits for the people of Esmeralda County. The plan opposes any designations of wilderness-type areas that reduce the multiple use aspect of the land. Esmeralda County opposes conversion of private lands to preservation categories, and aims to keep the county open for prospecting, mining, agriculture, and related activities.

Mineral County, Nevada: The Mineral County Master Plan has been updated and is in the approval process. The majority of the county is not privately owned.

Inyo County, California: The 2001 Inyo County General Plan is currently being updated. The current plan has four land use designations: residential, commercial, industrial, and other. State and federal lands fall with the "other" category. The goal of this category is provide adequate public facilities and services for existing or future needs of communities and their surrounding environments, and to conserve natural and managed resources. Although Inyo County is the second largest in California, more than 98 percent of the land is managed by federal, state, and city agencies. Due to this ownership pattern, Inyo County is very interested in coordinating with the policies of these agencies. The county is concerned about impacts of federal policies on county resources. The plan identifies goals and policies for the use of federal lands that support the economic and social welfare of the county's citizens. These include increasing the amount of private land in the county through land exchanges with public agencies, and increasing private uses on public lands to enhance economic development.

Fresno, Madera, and Tulare Counties, California: All have general plans in place that mention the need to coordinate with federal land management agencies and increase consistency across the various plans.

Mono County, California: Mono County is currently working on updating their 1993 General Plan. About 94 percent of the county is publically owned. The current plan encourages development adjacent to existing communities and clustering development to maximize open space. It discourages conversion of agricultural land to other uses. Mono County is interested in coordinating its policies with the policies of the various land management agencies in the county. Land use designations include residential, commercial, industrial, mixed use, agriculture, resource management, and scenic area agriculture. Inyo NF lands are mostly categorized under the "resource management" designation, which provides for low-intensity rural uses in a manner that recognizes and maintains resource values. The Mono Basin National Forest Scenic Area is categorized under the "scenic area agriculture" designation, which recognizes existing and historic uses and allows for further limited scale development consistent with the Mono Basin National Forest Scenic Area Plan.

Other Public Agencies and Municipalities

Los Angeles Department of Water and Power (LADWP): The 2010 Owens Valley Management Plan describes major management actions for LADWP lands covered by the plan. Goals include: continued water supply to Los Angeles, sustainable land management practices for agriculture and other resource uses, continued recreation opportunities on city-owned lands, improved biodiversity and ecosystem health, and protected and enhanced habitat for threatened and endangered species.

Additionally, the 2011 draft of the Owens Lakebed Master Plan provides a framework to manage the diverse resources of the lake, while continuing to control dust. About 95 percent of the lakebed is owned by the State of California and managed by the State Lands Commission. The majority of the remaining five percent is owned by the City of Los Angeles and managed by LADWP. Small areas are managed by the BLM, owned by Inyo County, or held privately.

Town of Mammoth Lakes: According to the 2007 General Plan, Mammoth Lakes aims to prioritize "infill" development. Residential, commercial, or industrial development outside the Urban Growth Boundary (UGB) is not permitted, though recreation and other public facilities and utility installations

may be permitted when determined to be in the public interest and compatible with other town goals. Mammoth Lakes aims to work with the Inyo NF to ensure that land uses next to the UGB are compatible with town goals. Any National Forest System (NFS) lands exchanged into private ownership would be included within the UGB, whether or not they are contiguous with the boundary.

Special Uses

Special uses are authorized uses and occupancy of National Forest System (NFS) lands. The Forest Service divides management of special uses into two categories. First, recreation special uses include recreation facilities open to the public, such as resorts and ski areas, as well services such as outfitting and guiding and recreation events. Recreation special uses also include private uses such as recreational residences. Second, lands special uses include uses such as water transmission lines, telecommunications, research, filming, and road and utility rights-of-ways.

Currently, the Inyo NF has 869 special use authorizations, 365 of which are lands special uses and 504 of which are recreation special uses. The largest proportion of lands special uses are road rights-of-ways, followed by irrigation water lines, research studies, and communication uses. The majority of recreation special uses are recreation residences, followed by outfitting and guiding services, boat docks and wharfs, and resorts. The forest has 31 permitted public recreation facilities, most notably the Mammoth Mountain and June Mountain Ski Areas. In addition to Forest Service permitted special uses, other special uses on the forest include hydroelectric projects operated under a license from the Federal Energy Regulatory Commission (FERC), state highways operated under California Department of Transportation easements, forest road and trail easements issued to the Town of Mammoth Lakes, and LADWP improvements authorized through legislation.

Applications for special use authorizations are expected to increase in the future. There is growing interest from individuals and companies to commercially operate on NFS lands to provide recreation opportunities to the public. Additionally, many of the resorts that currently operate under special use authorizations are expressing interest in expanding facilities and recreation opportunities they offer to the public. In terms of non-recreation special uses, there is increasing interest in energy development both on and off the forest. As development increases on private land, requests for ground water development on the forest are expected to increase.

Access and Access Patterns

Access is transportation access to or through the plan area, including pedestrian access from properties next to the plan area.

The main access to the Inyo NF is via U.S. Highways 395 and 6, and state Highways 168, 158, 120, 203, and 264. Many popular recreation areas are accessed by county roads. The popular Mammoth Lakes Basin is accessed by Lake Mary Road, which the Town of Mammoth Lakes maintains to the Twin Lakes Bridge. The Inyo NF maintains the road to the popular Reds Meadow/Devils Postpile National Monument area. Roads that are used for non-developed, dispersed recreation activities are either National Forest Transportation System (NFTS) or county roads. These roads are not only used by the public to access the Inyo NF for recreational uses, but also for non-recreational uses, commercial uses, and Forest Service management activities.

The Inyo NF has very few access easements across private land. Much of the access to the Inyo NF is through adjacent pubic land administered by the BLM and, to a lesser degree, lands owned by the LADWP. Because of the consolidated nature of the forest and the undeveloped nature of adjacent BLM and LADWP lands, access to the forest from adjoining lands is generally good despite the lack of acquired right-of-ways. A few areas exist where vehicular access to the Inyo NF could be affected by the lack of easements across private property. These areas include the east side of the White Mountains in the Chiatovich Creek, Indian Creek, and Montgomery Pass areas. On the west side of the White Mountains, specifically in the Hammil Valley area, access to a large area of the forest has already been blocked by private property owners. There are no cost share road agreements on the Inyo NF.

Access controlled by states and counties is not expected to change over the next couple decades. For access controlled by the Forest Service, the Inyo NF will continue implementing the 2009 motorized travel management decision by completing mitigations, blocking unauthorized routes, monitoring the effectiveness of closures, and patrolling. As discussed in Chapter 11 of this assessment, the Inyo NF is currently in the process of completing Travel Analysis Process Subpart A of the National Travel Management Rule.

The only airport that provides commercial air service in the eastern Sierra Nevada is the Mammoth-Yosemite Airport, operated by the Town of Mammoth Lakes (TML), and located approximately seven miles south of the TML. Commercial air service had been sporadic since 1973, even after TML acquired the airport from Mono County in 1992.

In 2007, year round service was initiated. A large part of the motivation to increase commercial air service was Mammoth Mountain Ski Area's desire to expand consumer markets and mid-week business, and the Town of Mammoth Lakes to become more of a destination resort. The Mammoth Yosemite Airport Terminal Development Plan includes a growth plan that projects increasing flights and destinations through 2028.

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

Land designated as National Forest System (NFS) land contributes to social and economic sustainability through the services and benefits that it provides to the public. The Inyo NF helps people connect to the land, to their history and culture, and to each other and their communities. The Inyo NF contributes to human wellbeing be providing the basic necessities of life, such as clean air and water, and offering physical and mental health benefits. The forest also contributes to local community wellbeing by providing economic opportunities for forest communities. Furthermore, it provides water that supports the economy of southern California. See Chapter 6 of this assessment for more information on social, cultural, and economic contributions that the Inyo NF makes, and Chapter 7 of this assessment for more information on ecosystem services and benefits from the Inyo NF.

By protecting and managing natural resources on NFS lands, the Inyo NF contributes to ecological sustainability. Designation of this vast landscape as a national forest helps protect ecosystem composition, structure, ecological processes, and connectivity. Healthy, functioning ecosystems are necessary for sustaining human societies and economies. Management zoning across the forest helps to ensure that a range of multiple uses are being managed for, while supporting the ecological sustainability of the

landscape. More information on ecological contributions can be found in Chapters 1 through 5 of this assessment.

Information Gaps

No major information gaps have been identified. Sufficient information exists to perform an assessment of land ownership, status and access.

Chapter 15: Designated Areas

Important Information Evaluated in this Phase

Designated areas are identified on the Inyo NF because of their unique or special characteristics. The Inyo NF currently has congressionally designated wild and scenic rivers, wilderness areas, national recreation trails, the Pacific Crest National Scenic Trail, the Mono Basin National Forest Scenic Area, and the Ancient Bristlecone Pine Forest Botanical Special Interest Area. Administratively designated areas include inventoried roadless areas, research natural areas, and national forest scenic byways.

Wilderness – Designated wilderness comprises forty-six percent of the Inyo NF, for a total of 964,360 wilderness acres. There are nine designated wilderness areas, either in whole or part, within the administrative boundary of the Inyo NF, including: Ansel Adams, Boundary Peak, Golden Trout, Hoover, Inyo Mountains, John Muir, Owens River Headwaters, South Sierra, and White Mountains Wildernesses.

Wild and Scenic Rivers – Four wild and scenic rivers are currently designated for the Inyo NF, with all or part of the river located within the administrative boundary of the forest. These four wild and scenic rivers are North Fork Kern River, South Fork Kern River, Cottonwood Creek in the White Mountains, and Owens River Headwaters.

Mono Basin National Forest Scenic Area (MBNFSA) – The MBNFSA was congressionally designated to protect geologic, ecologic and cultural resources within the 116,274 acre scenic area. The legislation which designated this area also specified that management would provide for recreation use and interpretive facilities, such as trails and campgrounds, and permit full use for scientific study or research.

Ancient Bristlecone Pine Forest Botanical Special Interest Area – The Ancient Bristlecone Pine Forest Botanical Special Interest Area was administratively established in 1958 to protect the bristlecone pines for public enjoyment and scientific study. In 2009, the 28,978-acre area was congressionally designated with the Omnibus Public Land Management Act.

Pacific Crest National Scenic Trail (PCT) - The PCT was congressionally designated in 1968 as one of the original national scenic trails. The Inyo NF manages 80 miles of the PCT. Ninety-six percent of this PCT mileage on the Inyo NF is located within designated wilderness, including the South Sierra, Golden Trout, John Muir, and Ansel Adams Wildernesses.

National Recreation Trails – There are two congressionally designated national recreation trails on the Inyo NF, including: Whitney Portal and Methuselah Trails. The Whitney Portal National Recreation Trail was established to protect the historic and scenic values of the original trail between the town of Lone Pine and the summit of Mount Whitney. The Methuselah National Recreation Trail is located within the

Ancient Bristlecone Pine Forest Botanical Special Interest Area, and was established to showcase the forest of ancient bristlecone pines.

Research natural areas (RNAs) – Seven RNAs have been administratively established on the Inyo NF, including: Harvey Monroe Hall, Indiana Summit, Last Chance Meadow, McAfee, Sentinel Meadow, Whippoorwill Flat, and White Mountain. These RNAs represent specific target elements, including alpine meadows, Sierran mixed subalpine forest, Jeffrey pine, foxtail pine, alpine fell-field, lodgepole pine, pinyon-juniper, and bristlecone pine. Potential opportunity for additional RNAs exists in aspen, sagebrush, xeric shrubland, and carbonate geology areas.

National forest scenic byways – Two national forest scenic byways have been administratively designated on the Inyo NF. Lee Vining Canyon Scenic Byway, located along Highway 120, stretches between Highway 395 at 6,781 feet in elevation near the town of Lee Vining and iconic Mono Lake to the Yosemite Park entrance. The Ancient Bristlecone Scenic Byway located along Route 168 and Forest Road 4S01, rises more than 6,000 feet in elevation from the Owens Valley up to the Patriarch Grove within the Ancient Bristlecone Pine Forest Botanical Special Interest Area.

Inventoried roadless areas - There are currently 542,119 acres of IRAs on the Inyo NF. The acreage designated as IRA constitutes 26 percent of lands administered by the Inyo NF.

Nature, Extent and Role of Existing Conditions and Future Trends

Wild and Scenic Rivers

Four wild and scenic rivers are currently designated on the Inyo NF, with all or part of the river located within the administrative boundary of the forest. The North Fork Kern River and South Fork Kern River are currently managed according to general direction in the 1988 LRMP plus specific direction found in a comprehensive management plan (USDA Forest Service 1994). Cottonwood Creek and Owens River headwaters are also managed according to general direction in the 1988 LRMP, but do not currently have more specific management direction in a comprehensive river management plan.

North Fork and South Fork Kern River

The upper 78 miles of the North Fork of the Kern River was designated as a wild and scenic river in 1987. The Inyo NF administers a portion of segment 2 of the river, which is designated as “wild”. The outstandingly remarkable values identified for segment 2 include scenic, recreation, fisheries, vegetation, cultural/historical and geologic values.

This wild and scenic river is entirely located within designated wilderness. Scenic, fisheries values and undeveloped qualities continue to be protected by wilderness designation of lands. The recreational characteristics include excellent hiking, pack stock trips, camping, fishing, solitude, and the outstanding visual experience. Visitor impacts to the river corridor remain minor due to the absence of trails on the most on the Inyo NF side of the river corridor.

The upper 72.5 miles of the South Fork Kern River were designated as a wild and scenic river in 1987. The Inyo NF administers the upper 28 miles of the river corridor, which is divided into four segments, starting at the headwaters and continuing downstream. The four segments of the river on the Inyo NF are within the “wild” or “scenic” opportunity class.

The resource setting is characterized by a primitive recreation opportunity class. Some human-caused modification of the environment is evident in localized areas. Visitor impacts to soils and vegetation in campsites and along trails are minor. The social setting is characterized by limited use, with good opportunities for solitude, and only occasional encounters with other visitors. The managerial setting is characterized by maintaining natural conditions and primitive recreation opportunities.

Properly functioning conditions (PFC) assessments found that the South Fork Meadow (segment 4) rated as "functional at risk" without an apparent trend. The rating was attributed to inadequate riparian cover and degraded channel geomorphic conditions as a result of head cuts (USDA Forest Service 2010a). In segment 4, PFC studies found that rest from livestock grazing since 2001 has resulted in a strong upward trend in meadow condition and stream bank stability in Templeton Meadows (USDA Forest Service 2012b). Studies also revealed that Monache Meadows area in segment 5 generally has the lowest proportion of sites meeting desired condition due to slow recovery from a recent stream-incision event in 1983. Scenic values continue to be protected within the river corridor by the CMP visual quality objective of preservation.

The aquatic species of concern, California Golden trout, may have stressors including livestock grazing, competition and predation from introduced brown trout, and hybridization with non-native trout. However, the U.S. Fish and Wildlife Service found that the potential threats are all addressed by the Conservation Assessment and Strategy for the California Golden Trout (USDA Forest Service and U.S. Fish and Wildlife Service 2004).

Cottonwood Creek in the White Mountains

The Omnibus Public Land Management Act designated 21.5 miles of Cottonwood Creek as a wild and scenic river in 2009 for its fisheries value. There are 17.4 miles are located on the Inyo NF and 4.1 miles are located on BLM land. Currently, the Inyo NF LRMP (USDA Forest Service 1988) provides the primary direction for administration of Cottonwood Creek. A specific comprehensive river management plan for this wild and scenic river has not yet been developed, but will be developed in partnership with the BLM. Current river channel conditions shows that streambanks are well vegetated and stable. There are no known issues with visitor impacts to natural qualities.

Owens River Headwaters

The upper 19.1 miles of the Upper Owens River and tributaries were designated as a wild and scenic river in 2009. The Inyo NF administers the entire river corridor, which is divided into eight segments classified as a "wild", "scenic" or "recreation" river. Currently, the Inyo NF LRMP (USDA Forest Service 1988) provides the primary direction for administration of Owens River Headwaters, until a specific comprehensive river management plan for this wild and scenic river is developed. Outstandingly remarkable values include: recreation scenic, geologic, fish and wildlife, and other values.

Environmental conditions (scenery, water quality, recreation) currently support outstandingly remarkable values with little to no evidence of degradation. However, river channel conditions are currently being improved with restoration measures being implemented as part of the Upper Owens/Bishop Creek OHV Restoration Plan for the scenic and recreation river segments.

Potential Need and Opportunity for Additional Wild and Scenic Rivers

Before the responsible official invites comments on the proposed plan, an inventory of the eligibility of rivers for inclusion in the Wild and Scenic Rivers System is required and will be completed.

One river was recommended for designation in the 1988 LRMP, the Middle Fork San Joaquin River. The Middle Fork San Joaquin flows through two national forests: the Inyo and the Sierra. The Sierra NF was assigned responsibility as the lead unit for making a recommendation to Congress for wild and scenic designation of the Middle Fork San Joaquin River. Congress has not yet taken action for wild and scenic designation of this river. Thus, the current status of the Middle Fork San Joaquin River remains as recommended for designation. In the interim, the Inyo's 1988 LRMP provides direction for managing segments of the Middle Fork San Joaquin River on the forest to retain the characteristics which make this river a candidate for designation.

Following adoption of the 1988 Plan, the Inyo NF completed an eligibility study of another 326 miles of river segments found on 28 streams on the forest. From this study, the forest determined that 169 miles of river segments on 19 streams met the eligibility criteria.

Wilderness

Designated wilderness comprises 46 percent of the Inyo NF, for a total of 964,360 wilderness acres. There are nine designated wilderness areas, either in whole or part, within the administrative boundary of the forest. The geographic area for these wildernesses ranges from 14,725 acres to 325,315 acres.

Designated wilderness on the Inyo NF

Wilderness Area	Designating Legislation (Public Law/Year)	Wilderness-Specific Management Plan? (Yes/No)	Visitor Permits Required? (Yes/No)	Area on the Inyo (Acres)	Trail System (Miles)
Ansel Adams	PL 88-577 / 1964; PL 98-425 / 1984; PL 111-11 / 2009	Yes	Yes	78,710	132
Boundary Peak	PL 101-195 / 1989	No	No	10,511	1
Golden Trout	PL 95-237 / 1978	Yes	Yes	193,630	216
Hoover	PL 88-577 / 1964; PL 111-11 / 2009	Yes	Yes	28,619	11
Inyo Mountains	PL 103-433 / 1994	No	No	74,512	28
John Muir	PL 88-577 / 1964; PL 111-11 / 2009	Yes	Yes	325,315	287
Owens River Headwaters	PL 111-11 / 2009	No	No	14,725	4
South Sierra	PL 98-425 / 1984	Yes	No	31,582	37
White Mountains	PL 111-11 / 2009	No	No	206,756	43

General direction for management for all wilderness area on the forest is contained in the Inyo NF LRMP (USDA Forest Service 1988). General wilderness management direction from the LRMP specifies that the forest should "maintain a predominantly natural and natural-appearing environment, facilitate low frequencies of interaction between users, and exercise necessary controls primarily from outside the wilderness boundary".

The Boundary Peak, Inyo Mountains, Owens River Headwaters, South Sierra and White Mountains Wildernesses rely solely on management direction in the LRMP, and do not currently have more detailed wilderness management plans. More detailed direction for managing the Ansel Adams, Golden Trout, Hoover, and John Muir wilderness areas is currently provided by wilderness-specific management plans.

Wilderness Conditions and Trends

There are 58 trailheads with daily use quotas which access areas within the Ansel Adams, Golden Trout and John Muir Wildernesses. Approximately 97 percent of the time, trailhead quotas are not filled. From the general public visitor permit data, the number of people entering wilderness for overnight use has remained steady or trended toward a slight increase over the past 13 years. Commercial pack stocking from 2001 to 2012 decreased.

The 10-Year Wilderness Stewardship Challenge (WSC) was developed by the Forest Service in 2004 as a means to quantifiably measure the agency's success in managing wilderness areas. A "minimum stewardship level" was defined as achieving a minimum score of 60 points.

For the FY 2012 reporting cycle, scores ranged from a high of 81 for the John Muir Wilderness to 41 for the White Mountains Wilderness. Scores have improved over time for the five wilderness areas that have not yet reached the minimum stewardship level, and have remained steady for the three wildernesses that currently meet the challenge.

WSC scores for Inyo NF wilderness areas are displayed in this table. While a portion of the Hoover Wilderness is on the Inyo NF, the lead data steward is the Humboldt-Toiyabe National Forests. Consequently, Hoover WSC scores are not tracked by the Inyo NF. In addition, although the forest has been tracking WSC scores, the Upper Owens Headwaters and White Mountains Wilderness are part of the original 10-year WSC, as they were not designated as wilderness until 2009.

Wilderness Stewardship Challenge scores for the Inyo NF

Total Score	Ansel Adams	Boundary Peak	Golden Trout	Inyo Mountains	John Muir	Owens River Headwaters	South Sierra	White Mountains
2009	69	33	49	36	79	NA*	37	NA*
2010	69	37	53	38	77	29	41	31
2011	71	41	63	42	79	43	51	39
2012	69	43	65	50	81	43	57	41

The forest has identified four elements for focus on improvement. There is a need to develop and implement wilderness education plans for the five wildernesses which do not currently meet the WSC

(Boundary Peak, Inyo Mountains, Owens River Headwaters, South Sierra and White Mountains Wildernesses). There is a need to develop and implement a monitoring protocol to measure opportunities for solitude or a primitive and unconfined recreation experience in the Boundary Peak, Inyo Mountains, Owens River Headwaters and White Mountains Wildernesses. Additionally, an information needs assessment should be completed for the five wildernesses which do not currently meet the WSC, along with collection of inventory and monitoring data as the needs assessments may identify.

Current trailhead quotas are expected to remain steady unless they are revised in the future. Because the majority of quotas are not filled, there is still potential for wilderness use to increase. Use patterns may shift and concentrated use in wilderness may be focused more heavily along the Pacific Crest and John Muir Trail corridors as a consequence of the growing popularity for hiking. There may also be increased future desire for outfitter/guide services in wilderness as part of the overall increasing demand for recreation on public lands, and an aging population who want more amenities during their visit.

Potential Need and Opportunity for Additional Wilderness

Before the responsible official invites comments on the proposed plan, a wilderness inventory and evaluation is required and will be completed. Many of the characteristics which are desirable when considering the opportunity to designate additional wilderness, such as large blocks of undeveloped natural landscapes with undisturbed ecosystem conditions, can be found within inventoried roadless areas (IRAs). Existing IRAs, along with all other lands within the plan area not currently designated as wilderness, will be considered during the inventory and evaluation for additional wilderness.

There are competing views of the need for additional designated areas, particularly wilderness. One prominent viewpoint holds that no additional wilderness should be recommended or designated on the forest. The opposing view recommends designation of additional wilderness, or other types of designated area, for the purpose of connecting habitat and providing for “quiet” recreation.

Scenic Areas, Trails and Highways

Pacific Crest National Scenic Trail

The Inyo NF manages 80 miles of the Pacific Crest National Scenic Trail (PCT). Ninety-six percent of this PCT mileage on the forest is located within designated wilderness, including the South Sierra, Golden Trout, John Muir and Ansel Adams Wilderness Areas. The primary purpose of the PCT is to provide for enjoyment of high quality scenic resources, primitive hiking and horseback riding opportunities, and to conserve natural, historic and cultural resources along the trail. The Pacific Crest National Scenic Trail Comprehensive Plan (USDA Forest Service 1982) provides direction for management of the trail.

The PCT offers outstanding scenic vistas along the entire 80 miles managed by Inyo NF. In the South Sierra and Golden Trout Wildernesses, travelers on the PCT enjoy views of the South Fork Kern River drainage and vast meadows located on the Kern Plateau. In the John Muir and Ansel Adams Wildernesses, PCT visitors experience stunning vistas of glaciated landscapes, including sparkling blue lakes with a backdrop of high, rocky peaks on the Sierra Crest.

The Inyo NF LRMP (USDA 1988) provides direction that 94 percent of the PCT corridor will be managed for preservation of the visual quality, while the remaining six percent of the corridor will be

managed to retain visual quality. The 1988 LRMP specifies that only non-motorized use will occur in a primitive or semi-primitive recreation opportunity setting. The areas allocated to the primitive or semi-primitive settings are entirely located within designated wilderness.

There are no authorizations for non-recreation special uses in these areas, such as wind turbines, utility transmission lines, or pipelines. Recreation special uses are authorized within the PCT corridor in the Reds Meadow Valley, including Reds Meadow Resort and Pack Station, and Agnew Meadows Pack Station.

Vegetation within the PCT corridor has been affected by disturbances associated with past wildfire and a severe wind event. Vegetation within the PCT corridor has also been affected by less frequent wildfire disturbance resulting from fire suppression.

Three wildfires occurred during the past 10 to 50 years. Portions of all these wildfires burned with high severity. Research found that wildfires burned every 14 to 18 years with low severity (Caprio et al. 2006). Fire suppression during the past century has resulted in the absence of such regular fire disturbance which increased density of smaller trees in the understory of mature forests, and led to encroachment of conifers into meadows. The increased density of trees creates high fuel loading and elevated hazard for high severity wildfire, such as seen in the Rainbow Fire of 1992. Conifer growth in meadows poses potential for loss of grassland sites in the future. The meadow encroachment is most notable in the smaller grassland sites along the PCT near Deer Creek, south of Reds Meadow. These meadows may become forested sites in the next few decades without future fire disturbance.

In November 2011, a severe wind event toppled thousands of trees within the PCT corridor in areas managed by Inyo NF. The most severe wind damage occurred in the vicinity of Reds Meadow, within the Middle Fork San Joaquin River watershed. The legacy of this wind damage will be high fuel loading and increased wildfire hazard in areas with blowdown.

The popularity of long distance trails is growing and there has been an increase in numbers of visitors for through-hike use on the PCT. This trend is expected to continue. The number of Pacific Crest Trail through-hikers in early June each year is large enough that South Sierra Wilderness occupied campsite standards are occasionally exceeded. Otherwise, there are no known campsite occupancy issues within the remainder of the PCT corridor associated with through-hikers. In the area where the PCT coincides with the John Muir Trail, there are known issues with capacity to accommodate large numbers of travelers on the John Muir Trail during peak wilderness use season, especially August.

The current trends in ecological conditions are expected to continue, including elevated fuel loads with risk of high severity wildfire, loss of meadows with conifer encroachment, and other ecosystem disturbance associated with climate change.

Whitney Portal and Methuselah Trails

There are two designated national recreation trails on the Inyo NF: Whitney Portal and Methuselah Trails (WPNRT). A third trail on the forest, the Discovery Trail in the Ancient Bristlecone Pine Forest, has been recommended for national recreation trail designation.

Established to protect the historic and scenic values of the original trail between the town of Lone Pine and the summit of Mount Whitney, the WPNRT is five miles in length, connecting the Lone Pine

campground at an elevation of 5,800 feet to the Whitney Portal trailhead at 8,300 feet. With this dramatic change in elevation, the WPNRT is steep and traverses several vegetation and climatic zones. This trail is available for day use, with travel on foot, snowshoes or cross-country skis.

The Methuselah National Recreation Trail (MNRT), located within the Ancient Bristlecone Pine Forest designated area, was established in 1983 to showcase the forest of ancient bristlecone pines. This trail provides visitors with opportunity to wander among the gnarled pines and wonder at living trees which are thousands of years old.

Mono Basin National Forest Scenic Area

The Mono Basin National Forest Scenic Area (116,274 acres), statutorily designated with the California Wilderness Act of 1984, directs management of the area to protect geologic, ecologic and cultural resources within the Mono Basin National Forest Scenic Area (MBSA).

A comprehensive management plan for the MBSA was completed in 1989. In this plan, action items direct development of recreation opportunities and interpretive facilities including a visitor center, while standards and guidelines are specified for management activities to protect resources and the scenic character of the area. A network of roads and trails currently provide recreational access to the MBSA.

The communities of Lee Vining and Mono City are located just outside of the scenic area administrative boundary. The communities have strong ties to the MBSA. Businesses in Lee Vining and nearby locations provide important services and amenities for visitors, and in turn, the patronization from visitors supports the local economy.

Ecosystems within the MBSA are dominated by sagebrush shrublands and the aquatic system of Mono Lake, which comprise 39 and 37 percent of the scenic area, respectively. Within the MBSA boundary, ecosystems have been affected by past wildfire disturbance. Over the past 50 years, 18 wildfires have occurred within the SA, affecting a total of 4,496 acres. In the more recent burns, such as the Mono Fire in 2010, the land remains sparsely vegetated because of sagebrush mortality during burning, and there has not been sufficient time for re-growth of sagebrush. In the older burns, such as the Lousy Fire in 1985, re-growth of sagebrush provides for quality wildlife habitat, notably for sage-grouse. Some fires in the Mono Basin have been invaded, at least partially, by cheatgrass within two to three years of the fire. The likelihood of invasion appears to be dependent on the occurrence of at least some cheatgrass at or near the site prior to the fire.

Trends for visitor use in the Mono Basin National Forest Scenic Area are expected to increase following the broader recreation trends. Commercial enterprises, organized events and research work, authorized by special use permit, are also expected to increase in the scenic area.

The majority of the landscape surrounding Mono Lake has relatively high scenic integrity with only a few developments altering scenic integrity. Under existing conditions, scenic stability is affected by ecological disturbance processes such as wildfire. Because of the mandates in the enabling legislation (Public Law 98-425), it is expected that future management of the area will protect geologic, ecologic and cultural resources within the Mono Basin National Forest Scenic Area.

Scenic Byways

Lee Vining Canyon Scenic Byway is a national forest scenic byway that stretches between Highway 395 at 6,781 feet in elevation near the town of Lee Vining and the iconic Mono Lake to the Yosemite National Park entrance. Lee Vining Canyon Scenic Byway offers dynamic views of rich and vibrant meadows, glacial mountain peaks rising precipitously from the canyon floor, and is a winding roadway cut precariously in the hillside. Scenic integrity along the Lee Vining Canyon Byway is high. Nearly 45 percent of the landscapes seen from the Lee Vining Scenic Byway contain naturally evolving to naturally appearing landscapes. The exceptions are hydropower facilities and power lines.

Ancient Bristlecone Scenic Byway is a national forest scenic byway that rises more than 6,000 feet in elevation from the Owens Valley, climbing through pinyon woodlands with occasional aspen stands. The road reaches the bristlecone pine forest at 9,000 feet, and offers vast views of the Owens Valley and Sierra Nevada mountains. The Ancient Bristlecone Byway travels through a landscape that is largely naturally evolving with limited human intervention and very high scenic integrity. There are no visual disturbances along this byway.

Highway 395 in Mono and Inyo County is a California State Scenic Highway. This Scenic Byway, spanning nearly 250 miles, passes through the Inyo NF as it travels through Mono and Inyo Counties. Mountain peaks ascend from the valley floor creating a backdrop both east and west, providing exemplary displays of land formations created by both ice and fire. Mono Lake, June Lake Loop, Mount Whitney (the highest mountain in the contiguous United States), and the Ancient Bristlecone Pine Forest are just a few iconic places one can visit from this byway. There are many small communities along this route that provide access to the Sierra Nevada, White, and Inyo Mountains

Traffic is expected to increase on the scenic byways, as a result of predicted overall increase in visitor recreational use. Future trends related to scenic stability will be driven by ecosystem disturbance processes such as fire and wind.

Inventoried Roadless Areas

Currently on the Inyo NF, there are 542,119 acres of inventoried roadless areas (IRAs). Some of the inventoried roadless areas are very small in size as the majority of the area was designated as wilderness since establishment of the IRA. The acreage designated as IRA constitutes 26 percent of lands administered by the Inyo NF. When roadless area acreage is combined with wilderness acres, these two types of designated areas comprise 72 percent of the forest land base. Existing IRAs will be considered during the inventory and evaluation for additional wilderness.

IRAs are managed to maintain certain values and characteristics such as high quality or undisturbed soil, water, and air resources, diversity of plant and animal communities and their habitat, and primitive, semi-primitive non-motorized classes and semi-primitive motorized classes of dispersed recreation. Despite the implication of their name, roadless areas can and do contain motorized roads and trails. However, reconstruction of existing roads and construction of new roads is generally not permitted.

Under current conditions, 139 miles of motorized trails, 163 miles of roads suitable for high clearance vehicles, and 32 miles of roads suitable for passenger cars, including paved roads, are located within IRAs. Developed sites also occur within some of these IRAs under existing conditions. There are campgrounds or other recreation facilities within the following IRAs: Hall Natural Area, Horse Meadow,

Laurel McGee, San Joaquin, Boundary Peak, Coyote Southeast, North Lake, Rock Creek West, Tinemaha, Independence Creek, and South Sierra. The presence of many of these developed sites was acknowledged when IRA boundaries were mapped in the 1970s.

Twenty-one of the IRAs (43,151 acres) geographically overlap with the wildland urban interface (WUI). In these areas, there is a need and there are management mandates to establish wildfire defensible space around communities and developed sites where people congregate on the forest.

Under the Roadless Area Conservation Rule (RACR, USDA Forest Service 2001d, 36 CFR Part 294) road construction and tree cutting, sale or removal is generally prohibited, with limited exceptions for thinning of small diameter trees to reduce the risk of uncharacteristic wildfire. These exceptions do allow for some vegetation management and fuels reduction actions for the purpose of creating wildfire defensible space in the WUI.

Many of the characteristics which are desirable when considering the opportunity to designate additional wilderness, such as large blocks of undeveloped natural landscapes with undisturbed ecosystem conditions, can be found with IRAs. Existing IRAs will be considered during the inventory and evaluation for additional wilderness, as will all other lands on the Inyo NF.

Under current conditions, 139 miles of motorized trails, 163 miles of roads suitable for high clearance vehicles, and 32 miles of roads suitable for passenger cars, including paved roads, are located within IRAs.

There is no existing compiled dataset to evaluate the current ecological conditions of IRAs in the context of the eight roadless area characteristics defined in the RACR (USDA Forest Service 2001).

Many of the characteristics which are desirable when considering the opportunity to designate additional wilderness, such as large blocks of undeveloped natural landscapes with undisturbed ecosystem conditions, can be found within IRAs. Existing IRAs will be considered during the inventory and evaluation for additional wilderness, as will all other lands on the Inyo NF.

Botanical and Research Natural Areas

Ancient Bristlecone Botanical Area

The Ancient Bristlecone Pine Forest Botanical Special Interest Area (ABPF) supports subalpine conifer forest assessment type, which includes bristlecone pine forest, but also the sagebrush shrub, mountain mahogany, and pinyon-juniper assessment types. Visitors come from around the world to see the oldest living trees on the planet. Some of the bristlecone pines found here are more than 4,000 years old, and as such have attracted world-wide attention. Records suggest that approximately 32,500 people visit the ABPF each year (USDA Forest Service 2013).

Roads and trails are limited to existing routes except for interpretive roads and trails. Under current direction, pests are managed only when necessary to preserve the values for which the area was established. In addition, the LRMP prescribes that all wildfires will be controlled, and natural fuels will be allowed to accumulate.

Changes in climate have the potential to significantly affect the ABPF. Though it is difficult to predict the complex interactions of potential changes in temperature, precipitation, and shifting insect and disease ranges, existing habitat, expansion of young bristlecone pines into both higher and lower sites (Millar in Nash 2010) and older dead trees above current tree line indicate the potential for upslope shifts in distribution to accommodate a warming climate. Shifting patterns of various insects and diseases in response to long term changes in climate could affect existing bristlecone pine stands within the ABPF, particularly at the lower tree limit.

Research Natural Areas

Research natural areas (RNAs) are National Forest System (NFS) and other public lands permanently protected to maintain biological diversity and provide ecological baseline data, education and research. Only non-manipulative research is allowed within the RNAs. RNAs have been selected based on vegetation target elements.

The RNAs recommended in the 1988 LRMP have been officially established and include: Harvey Monroe Hall, Indiana Summit, Last Chance Meadow, McAfee, Sentinel Meadow, Whippoorwill Flat, and White Mountain.

The following is a synopsis of the Inyo NF RNAs (Cheng 2004):

Harvey Monroe Hall: Recreation use is not heavy. Inyo NF ecology plot observations indicate several patches of wind-fallen trees occur in the RNA, following the same wind event that affected Reds Meadow in December 2011. Photography over the last several decades indicates that the Conness Glacier, which occurs in this RNA, has become reduced in size.

Indiana Summit: A unique feature of this RNA is the piagi trenches, dug by Paiute Indians to harvest the larvae of piagi moths. Although not authorized, off highway vehicle travel and woodcutting occasionally occur in the RNA. A single ecology plot in this RNA illustrates the typically late seral conditions, with several down logs and snags, and several small to mid-size trees below the main canopy.

Last Chance Meadow: The Last Chance Meadow RNA includes extensive stands of foxtail pine, with trees attaining ages of 1,000 to 1,500 years. Three ecology plots demonstrate the widely-spaced forest structure, with some areas of frequent down logs and snags, and inclusions of unique shrub communities.

McAfee: The McAfee RNA is within the most accessible, as well as one of the largest continuous areas of alpine steppe in California. As a result, it has a long history of high altitude research and projects related to climate change.

Sentinel Meadow: The presence of species such as mountain hemlock and western white pine suggests that this area receives more precipitation than expected given its location in the east side rain shadow of the Sierra Nevada. The 1985 Owens Fire is the only recorded fire that has affected this RNA in its southwest corner. However two ecology plots, one conducted in lodgepole pine and the other in whitebark pine-lodgepole pine, contain old burned snags and down logs with charcoal.

Whippoorwill Flat: The RNA is characterized by a well-developed pinyon forest with numerous "specimen" trees, and some clearings dominated by sagebrush. Signs of Paiute and Shoshone pre-historic inhabitance are plentiful, due to the large supply of pinyon pine nuts, an important food source.

White Mountain: The White Mountain RNA is most well-known for the paleo-climatic research that has occurred there since the early 1950s. Research has also focused on edaphic restrictions of the different vegetation types. Aside from a trail, direct human impact is negligible.

Although RNAs are intended to represent intact ecosystems, indirect effects of some practices or human influences do exist in these areas. In particular, fire management and invasive species introductions interfere with the purpose of maintaining a pristine and diverse setting. No invasive plant species are currently mapped within any of the RNAs; however, cheatgrass in particular is likely in at least some of the RNAs, such as Whippoorwill Flat, Indiana Summit, and Sentinel Meadow.

Fire return interval departure (FRID) is a measure that provides a rough estimate of the difference between the current fire frequency and the fire frequency prior to Euro-American settlement. For subalpine forest (Last Chance Meadow, Sentinel Meadow, White Mountain RNAs), the FRID dataset indicates low departure from historic, meaning that current and past fire frequencies are similar. For pinyon-juniper (Whippoorwill Flat RNA), most areas of the forest were also found to have low departure. However, Jeffrey pine (Indiana Summit RNA) is strongly departed at the forest-wide scale, with fires occurring with a much lower frequency than in the past. No information about FRID was available for alpine and meadow settings (Harvey Monroe Hall and McAfee RNAs).

Past fire suppression has affected ecological conditions in some of the RNAs, as evident in changes in canopy profiles, fuel build-up, and, in some cases, species composition. Ecological conditions are likely to move farther away from the natural range of variation unless changes are made in fire management policies. Changes in climate have the potential to affect existing RNAs in the coming years. Changes in vegetation composition and structure of target elements, and even loss of the target element communities within RNA areas, is possible, depending on the degree and direction of climate change.

Invasive species will likely continue to spread on the forest, potentially entering RNAs in some areas. The overall lack of ground-disturbing activities and external vectors, such as cars, bicycles and horses, provide some resistance to invasion. However, invasions are likely to occur in RNAs, unless active prevention and control methods are implemented.

Potential Need and Opportunity for Additional RNAs

Additional RNAs may also be considered based on assessment types that were absent or under-represented in the RNA system. Potential need and opportunity for designation of additional RNAs was identified primarily for aspen, sagebrush, and xeric shrublands vegetation types, as well as for carbonate areas, which are characterized by unique geology and vegetation. The Forest Service Pacific Southwest Region compiled proposed and potential RNAs for all national forests in 2005. For the Inyo NF, the Whitewing Mountain RNA is proposed, and Aspen Grove and Coyote Ridge were identified as potential. These three proposed or potential RNAs represent subalpine forest, aspen, sagebrush, and alpine types.

Contributions the Plan Area Makes to Ecological, Social or Economic Sustainability

Communities with ties to the Inyo NF typically depend on the forest for support of livelihoods and life-ways. Recent economic studies have shown that “counties with national parks, wilderness, and other forms of protected public lands benefit through increased economic performance”, including stimulating economic growth, enhancing nearby private property values, accelerating employment growth and

increasing per capita income compared to other areas (Rasker et al. 2013, Rasker 2006, Phillips 2004). Designated areas with special protections on the Inyo NF are known to have a positive influence on the local economy through tourism and permitted commercial uses. For example, numerous communities serve as "gateways" for the public to secure lodging or purchase food, fuel and other supplies while visiting these designated areas. In addition, designated areas provide outdoor recreation activities which foster health and wellness, and offer connections to a protected scenic landscape which supports a high quality of life in the region.

Trail systems, including the Pacific Crest National Scenic Trail and two other national scenic recreation trails, as well as many connecting trails provide local social and economic contributions. Trails are an invitation into nature allowing the appreciation of wild scenery. Trails through the Inyo NF are a refuge from industrialized civilization. Solitude and detachment from routine social pressures and distractions provide the setting for inward reflection and self-discovery. Hiking can present a physical challenge leading to a sense of personal accomplishment.

As populations increase the sustainability trails may be in question. While trail maintenance funding is flat or declining, partnerships have been an important source of trail maintenance. The Inyo NF's ability to engage the public and increase its partnerships will be a factor in determining the sustainability of these important social outlets.

The social, economic and ecological benefits of wild and scenic rivers provide managers with tools to protect free-flowing condition, protect and enhance water quality, and promote economic development, tourism, and recreational use. Wild and scenic rivers enhance social values by encouraging management that crosses political boundaries as well as by promoting public participation and partnerships to conserve river values. The Inyo has identified an additional 15 rivers eligible for wild and scenic designation. Additionally, wild and scenic rivers are an increasingly important resource in a time of significant climate change as they secure environmental flows through the federal reserved water right created to protect values.

Wilderness areas contribute significantly to our nation's social, economic and ecological health and wellbeing. Designated wilderness comprises 46 percent of the Inyo NF, totaling 964,360 acres and supports approximately 55,000 visitors annually. On the Inyo NF wilderness also supports commercial pack stocking, providing local business opportunities. Wilderness is a haven for self-discovery and rejuvenation. Wilderness areas are important sources of clean water and air, as well providing high quality habitat. While the benefits of wilderness transcend boundaries, they are influenced by human activities outside wilderness such as non-native species, pollution and fire suppression.

Research natural areas (RNAs) contribute to ecological sustainability by permanently protecting and maintaining biological diversity, providing ecological baseline data, education and research. The sustainability of vegetation target elements represented in RNAs is influenced by indirect effects from fire management and invasive species. Indirect effects from fire management and invasive species introductions can alter these ecosystems. In many cases, the occurrence of fire is necessary to maintain the target elements of the RNA. Climate change presents a special challenge since the baseline or reference area may change. Climate will also affect biotic populations directly.

Scenic byways contribute to social, economic and ecologic sustainability similarly to the trails, although the experience may be less intimate and less physical. Scenic byways allow a different user group to have

experiences with nature. Driving for pleasure is one of the most popular outdoor recreation pursuits in California and the country. Use of scenic byways also leads to economic benefits from tourism.

Information Gaps

Although the Inyo NF does have important information relating to designated areas, including a large body of on the ground experience with RNAs, more information is needed on the extent of invasive plants in the RNA system on the forest. There is no existing compiled dataset to evaluate the current ecological conditions and characteristics of inventoried roadless areas. Additionally, information and inventory is lacking for five wilderness areas. Wilderness character monitoring baselines needs to be established. An information needs assessment is currently underway to identify specific priority information needs. For the new wild and scenic rivers, a baseline condition assessment still needs to be established for free flow, water quality, and outstandingly remarkable values, including a detailed resources assessment of off highway vehicles. The baseline has not yet been established and documented in a comprehensive river management plan.

CONCLUSIONS

Chapter 1: Terrestrial, Aquatic, and Riparian Ecosystems

Land-based, or terrestrial ecosystems, are diverse on the Inyo NF, with nine broad-scale terrestrial ecosystem types identified, and several special types, including aspen, alkali flats, and dry forb communities, plus aquatic and riparian ecosystems. Ecological integrity of terrestrial ecosystems varies by type and location on the Inyo NF. Major drivers and stressors of these ecosystems include climate change, insects/disease, grazing, fire, invasive species, timber and vegetation management, and recreation. Ecosystem structure and function are assessed in the context of their natural range of variability; this recently developed method for examining ecosystems, under the 2012 Planning Rule, provides the context for determining whether ecosystems are functioning properly and in a sustainable manner. This type of analysis presents unique challenges in determining whether climatic and ecosystem conditions expected over the upcoming planning period have been experienced in the past, and whether those historic conditions will be sustainable into the future.

In xeric shrublands and sagebrush ecosystems, conifer encroachment, and changes in fire regime and invasive species compromises ecological integrity. Fire suppression and limited forest management has led to some increases in forest density, and uniformity of structure and fuels in Jeffrey pine, mixed conifer, and red fir. In alpine ecosystems and subalpine forests, climate change is causing changes in ecosystem composition.

Aquatic and riparian ecosystems have varied ecological integrity. These are at risk from climate change, including decreased precipitation and changes in seasonal patterns and proportions of snow vs. rain. Extensive water development has changed water flow and timing, and reduced the habitat extent of some species and changed the habitat of others, and the introduction of non-native trout has altered animal diversity, as has chytrid fungus in amphibians. Meadows have been affected by past and current grazing management, water development, road placement, and recreation. Various methods have indicated that the majority of meadows on the forest are in good condition with respect to vegetation and soils, but that a small proportion is in poor condition or even non-functional. Under effective grazing management, aquatic and riparian conditions are expected to improve across the forest.

Chapter 2: Assessing Air, Water and Soil Resources

Air quality on the forest is often affected by conditions outside the forest, although prescribed burning accounts for a small fraction of particulate matter. All burning is coordinated with the state which regulates burning activity; thus, burning activities have always complied with air standards.

Water quality is generally good on and off the forest. Los Angeles Department of Water and Power reports show that water quality met all drinking water standards. However, there are some local water quality impacts from grazing, roads, dispersed and developed recreation.

Water is used on the forest to support multiple uses, and conflicts between those uses will continue. Many of the perennial streams on the forest are impounded, providing water for power generation, domestic and municipal use. There are approximately 380 surface water rights on the forest. Groundwater is also used for municipal, recreational and administrative use, with future demands expected to increase with population growth and conflicts over surface water use. Some models predict a

decrease in water availability due to global climate change, potentially adding to the water demand pressure.

Soils across the forest are generally in good condition with erosion, compaction, and disturbance limited to relatively small areas, mostly related to roads, developed and dispersed recreation, and grazing in meadows. The forest has an active restoration program that is reducing adverse soil effects across the forest.

Chapter 3: Assessing System Drivers and Stressors

Ecosystem drivers are the dominant ecological processes, including disturbance regimes, such as wildland fire, natural succession, and the balance between the biological and physical components of an ecosystem, including climate. Stressors which result in an imbalance of ecological processes include altered disturbance regimes, non-native species invasions, and climate change. Drivers and stressors are closely related, and have direct influence and feedback mechanisms with ecosystem structure and function. Drivers and stressors were discussed throughout the assessment, in the context of the specific resources which they affect. In this chapter, the focus was on forest-wide departures between current conditions and historic disturbance regimes. Fire regime was found to be departed in some areas, but within the natural range of variability in others. Although insects and disease have occurred throughout history on the forest, recent outbreaks indicate a trend of increasing size and severity of outbreaks, possibly linked to climate change. All these factors, in addition to anticipated changes in species distributions over the upcoming decades, are expected to result in strong changes to ecosystem structure and composition. Socioeconomic factors, including recreation, multiple uses, and population growth, are also drivers and stressors, and long term resilience and sustainability of ecosystems will require addressing interactions among them all.

Chapter 4: Assessing Carbon Stocks

Climate change, shifted fire regimes, grazing, vegetation management, insect and disease, and population growth impact the amount of carbon the Inyo NF can store. California's national forests are expected to be net carbon sinks over the next several decades until around about the middle of this century. At that point, carbon losses from wildfire, disease, and other disturbances will exceed sequestration, and forests will become net emitters. The large extent of meadows and shrublands on the Inyo NF and findings regarding their importance to carbon storage, suggest that these ecosystems and their restoration will play an important role in carbon sequestration over the upcoming decades.

Chapter 5: At-Risk Species

There are currently 92 species identified as at-risk. Ten are federally listed under the Endangered Species Act (two as endangered, two as threatened, two as candidates, and four as proposed) and the remaining 79 are potential species of conservation concern. Of the potential species of conservation concern, 60 are plant species, 13 are terrestrial wildlife species, and six are aquatic wildlife species. These species cover a wide range of ecological conditions although there is a concentration of species around a few key ecosystems such as: alpine and subalpine areas and forests; sagebrush; springs and seeps and other aquatic types; riparian and meadow systems; and alkaline or limestone soils. In addition, some key ecosystem components such as caves and mines, snags and down logs, and riparian vegetation are important for several at-risk species.

A key risk factor is climate change. Climate change may affect both the current and future distribution of habitat and habitat connectivity, in addition to directly affecting species sensitive to changes in hydrology, temperature, or the seasonality of weather. Because many at-risk species occur in either the extremes of the cool high mountains or the hot and dry lowlands, climate change can have a substantial effect by making harsh living conditions even more difficult for species to survive and breed. Continuing and past impacts from livestock grazing may be a risk factor for several species, primarily those associated with aquatic systems, riparian areas and meadows. Invasive species are a key risk factor for many terrestrial, aquatic, and plant species. Severe fire is another key risk factor primarily affecting the short and long term availability and quality of conifer forest habitats. Fire is also a critical driver that affects the distribution of pinyon-juniper and sagebrush habitats. Finally, habitat fragmentation and disturbance from human activities are key risk factors for several species, particularly as human population grows and drives increased use and development in and adjacent to the forest.

Chapter 6: Assessing Social, Cultural and Economic Conditions

The Inyo NF provides recreational opportunities to people across the region, state, country and world. This visitation and associated activities are vital contributors to local economic conditions in the communities surrounding the forest. Water flowing off of the Inyo NF is extremely important for municipal water supply in southern California. This water supply may be adversely impacted by the effects of climate change and increased demand and competition for water. Population growth in southern California could increase demand for surface and groundwater in and adjacent to the Inyo NF. Nationally, people are becoming increasingly disconnected from nature and outdoor experiences, particularly those who live in urban areas. Many people from culturally diverse backgrounds are under-represented as visitors on national forests and other public lands. This disconnect may grow as populations, urbanization and cultural diversity increase.

Chapter 7: Benefits to People

The Inyo NF is unique in the benefits and services it provides to the American people. These benefits are a function of the features and landscapes found on the forest. Ecosystem services such as recreation are enjoyed directly by individuals and communities and as a result, their contribution to our wellbeing is more easily understood. Other vital ecosystem services provide benefits that are less apparent in our daily lives but are none the less important as they support and regulate the ecosystems in which people live. Cultural heritage, carbon sequestration and biodiversity are examples of these kinds of services.

Chapter 8: Multiple Uses-Fish, Plants and Wildlife

A wide variety of fish and wildlife species and hundreds of plant species are found on the Inyo NF. The presence of a variety of vegetation, wildlife, and aquatic species, in ecosystems that are visited by the public, provides many opportunities for passive recreation such as nature watching, as well as active and direct connections through fishing and hunting.

Under current management direction, the ability to sustain angling use remains high over the next 10-20 years. Fishing is recognized as an important economic factor among the local communities and the forest will continue to provide habitat for fish.

Based on the current conditions for big game habitat within the assessment area, the level of mule deer, elk, and black bear hunting opportunities are expected to remain stable and that will persist into the next

10-20 years. Habitat improvements may be needed in some areas of the forest to ensure suitable foraging habitat is available to big game species, such as mule deer. Current management direction allows for the continuance of suitable habitats needed for the upland game bird and small mammal species. Although there are some localized impacts from drivers and stressors, the populations of these species continue to allow for hunting use.

Chapter 8: Multiple Uses-Range

Currently, there are a total of 49 livestock allotments on the Inyo NF, 38 of which are active. In 2012, 4,717 head of cattle and 15,350 head of sheep were permitted to graze at various times throughout the year on the forest, with the primary grazing season being between June 15 and September 30.

While generally good, rangeland conditions vary throughout the forest, based on data collected to assess vegetation conditions, watershed function, and hydrologic function. The Inyo NF conducts annual monitoring of range best management practices (BMPs) to evaluate impacts to water quality and aquatic habitat. Of the total of 24 range allotment evaluations conducted, 16 were rated as both implemented and effective. Another four rated as implemented at risk, meaning that although the BMPs were correctly implemented, minor departures from effectiveness were noted. The remaining four evaluations were rated implemented but not effective, meaning that although the BMPs were implemented as planned, they were not effective in preventing adverse effects on water quality.

Ecological restoration will contribute to the sustainability of grazing on the Inyo NF. Meadow restoration will remain a priority. An assessment is in progress between the Forest Service and University of California Davis to estimate trends over the last 20 years. Over 800 monitoring sites have been established on the national forests in California since 1999. Results from this study are expected in the near future which will provide a more meaningful assessment of rangeland condition and trend and response to grazing management, as well as to weather and other factors.

Chapter 8: Multiple Uses–Timber

The Inyo NF contains approximately 62,000 acres of productive forest land which are suitable for active timber vegetation management. While the forest continues to steadily implement forest health and resilience treatments on these suitable productive forest land acres, the forest is growing wood at a rate over four times faster than the rate at which treatments are being implemented.

The vast majority of local processing of forest products is for fuelwood. Milling of timber resources for products other than fuelwood is minimal and limited to a few local individuals who manufacture items such as post and poles, rough siding, arts and crafts, furniture and other products.

The Inyo NF conducts timber vegetation treatments aimed at reducing stand density by thinning to improve overall forest health through increased resilience to drought, insects and disease and wildfire. Prescribed fire is also an extremely important treatment method benefitting the timber resource, both in and out of the wildland urban interface (WUI). Climate change, fire management, insects and disease, and markets for wood products were identified as major drivers/stressors of timber resources. Management practices which result in lower tree densities may provide for increased resilience to expected climate change and other stressors over the upcoming decades.

Chapter 9: Recreation Settings, Opportunities and Access, and Scenic Character

The Inyo NF maintains a stunning scenic landscape, drawing 2.5 million annual visits from local residents and tourists. The forest currently provides for a broad range of opportunities and settings, and people generally have a very high level of satisfaction when they visit. However, demand for recreation opportunities is going up and various factors may influence the sustainability of recreation resources in the future. Changing demographics and interests are expected to influence recreation preferences and expectations. At the same time, fewer resources are available to maintain and operate existing recreation facilities, develop new opportunities, or provide management of recreation. Unmanaged recreation can have negative ecological consequences, which, in turn, can negatively impact recreation opportunities. To help meet public demand, partnerships are expected to play an increasing role in providing recreation opportunities on the forest. While scenic integrity may be high, many valued scenery attributes have low scenic stability due to the departure of existing vegetation and fire regimes from the natural range of variation.

Chapter 10: Energy and Minerals

The Inyo NF has a commercial value to the people of California resulting from hydroelectric development projects on four streams (watersheds) on the forest. Many of the major canyons (watersheds) suitable for major hydropower development on the Inyo NF have already been developed. There are no permitted wind power facilities or testing sites approved on the Inyo NF and the forest is not identified as a high-potential area for wind energy. The 62,000 acre Mammoth Lakes – June Lake core timber management area is the most likely source area for biomass material in the eastern Sierra Nevada. Seven geothermal leases currently exist on the forest and the potential for future geothermal exploration includes drilling of exploration wells and geophysical testing. There are no permitted solar power facilities currently approved on the Inyo NF but the forest has a high potential for solar development.

Active mining claims are present within the Inyo NF and include lode, placer, and mill site claims. Mining activity on the Inyo NF is likely to continue based on existing and past exploration, production, and milling activities in the area. Mineral materials are found throughout the Inyo NF, but most are currently used only for forest administrative use, with the exception of one gravel pit used by other federal, state and local agencies. Abandoned mine sites are present throughout the broader landscape, and tend to be found in higher concentrations in the White Mountains, Inyo Mountains, and areas of the Sierra Nevada with rock types associated with mineralization. Geologic hazards on the forest include earthquakes, volcanic hazards, hazardous gases, and mass wasting.

Chapter 11: Infrastructure

Infrastructure is vital to supporting the use and management of the Inyo NF, protecting resources, and providing benefits to the public. The forest has been able to broadly meet goals for managing its infrastructure so that it is safe and functional. However, lack of funding for routine maintenance of infrastructure has led to a backlog of deferred maintenance and much infrastructure that it is in a poor condition. Future challenges are also expected to grow due to aging infrastructure, the increasing deferred maintenance backlog, increasing requirements for resource protection, and declining budgets. As a result, more emphasis on partnerships is expected in the future. Other planning efforts are also underway to help the agency prioritize future management strategies regarding infrastructure.

The major public utility companies that operate on the Inyo NF include Southern California Edison, Verizon of California, Verizon Wireless, AT&T, Los Angeles Department of Water and Power, California Broadband Cooperative, and Ormat Technologies, Inc. Private infrastructure refers to privately-owned facilities used in conjunction with special use authorizations, and includes water and wastewater permits, recreation residences, resorts, ski areas, and marinas, among others.

Chapter 12: Areas of Tribal Importance

Tribes are concerned about the continued protection of and access to culturally important resources and areas of tribal importance. The Inyo NF continues to consult and work with tribes on issues that are important to them and to ensure their rights are protected. Various, mutually beneficial opportunities exist to further enhance relationships between the Inyo NF and tribal communities.

Chapter 13: Cultural and Historical Resources and Uses

Cultural and historical resources are valuable for their scientific contributions. They help people understand who they are and where they came from. They can provide valuable recreation experiences that support local economies through heritage tourism. Cultural and historical resources often have great significance to Native Americans. Cultural resource sites are at risk from a number of stressors. In general, cultural resources are inherently fragile and non-renewable. Efforts to programmatically manage sensitive cultural resources are hindered by data gaps in the number, location, and condition of cultural resources on the forest. These data gaps make it difficult to provide a snapshot of current cultural resource condition.

Chapter 14: Lands

The Inyo NF is fairly consolidated, having acquired most of its high priority parcels over the years. Mono and Inyo Counties continue to have concerns about future opportunities for local communities. Because so little of the land is in private ownership, changes in land ownership, status, or access can have major impacts on the wellbeing of local communities. Increasing demand for recreation opportunities and for communications technology and energy development may influence forest land status and uses in the future. Accordingly, requests for special use authorizations are expected to increase as well. Much of the access to the Inyo NF is though adjacent public land administered by the Bureau of Land Management and to a lesser degree, lands owned by the Los Angeles Department of Water and Power (LADWP). Because of the consolidated nature of the forest and the undeveloped nature of adjacent BLM and LADWP lands, access to the forest from adjoining lands is generally good despite the lack of acquired right-of-ways.

Chapter 15: Designated Areas

The Inyo NFs supports numerous scenic and recreation opportunities. The Pacific Crest National Scenic Trail (PCT) winds 80 miles through the forest with 96 percent within wilderness areas. The wilderness designation protects the outstanding attributes of the PCT as well as John Muir, Whitney Portal, and Methuselah Trail systems. Wilderness, along with inventoried roadless areas, account for 72 percent of the land managed by the forest. The trails and wilderness support current use demand with 97 percent of the trailhead quotas not filled. The area, due to fire suppression, maintains a high fuel load with some meadows exhibiting signs of forest encroachment. As a result, the areas may experience extreme fire behavior and possible loss of meadow habitat.

On the Inyo NF there are 160 miles of wild and scenic rivers that maintain the outstanding remarkable values for which they were designated. Presence of wilderness and wild and scenic management plans ensure conditions will persist. Some degradation of meadows has been noted from compaction and channel incision but monitoring shows that conditions are improving.

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HELPFUL LINKS

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http://www.fs.usda.gov/main/inyo/landmanagement/planning

US Forest Service Pacific Southwest Region Plan Revision website
http://www.fs.usda.gov/main/r5/landmanagement/planning

USFS Plan Revision website
http://www.fs.usda.gov/planningrule

Sierra Cascades Dialog
www.fs.usda.gov/goto/r5/SierraCascadesDialog

Our Forest Place
http://ourforestplace.ning.com/

The Living Assessment
http://livingassessment.wikispaces.com/

PSW Science Synthesis
http://www.fs.fed.us/psw/publications/reports/psw_sciencesynthesis2013/index.shtml

History page for Sierra Nevada Forest Planning
http://livingassessment.wikispaces.com/Brief+History+of+Sierra+Nevada+Forest+Planning

USFS Pacific Southwest Region Ecological Restoration
http://www.fs.usda.gov/detail/r5/landmanagement/?cid=STELPRDB5308848

Forest Service Road Accomplishment Reports
http://www.wildlandscpr.org/2006-and-2007-road-accomplishment-reports-rars

Forest Service Travel Management
http://www.fs.usda.gov/main/r5/recreation/travelmanagement

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